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HOME COMPUTER

magazine

July, 1983

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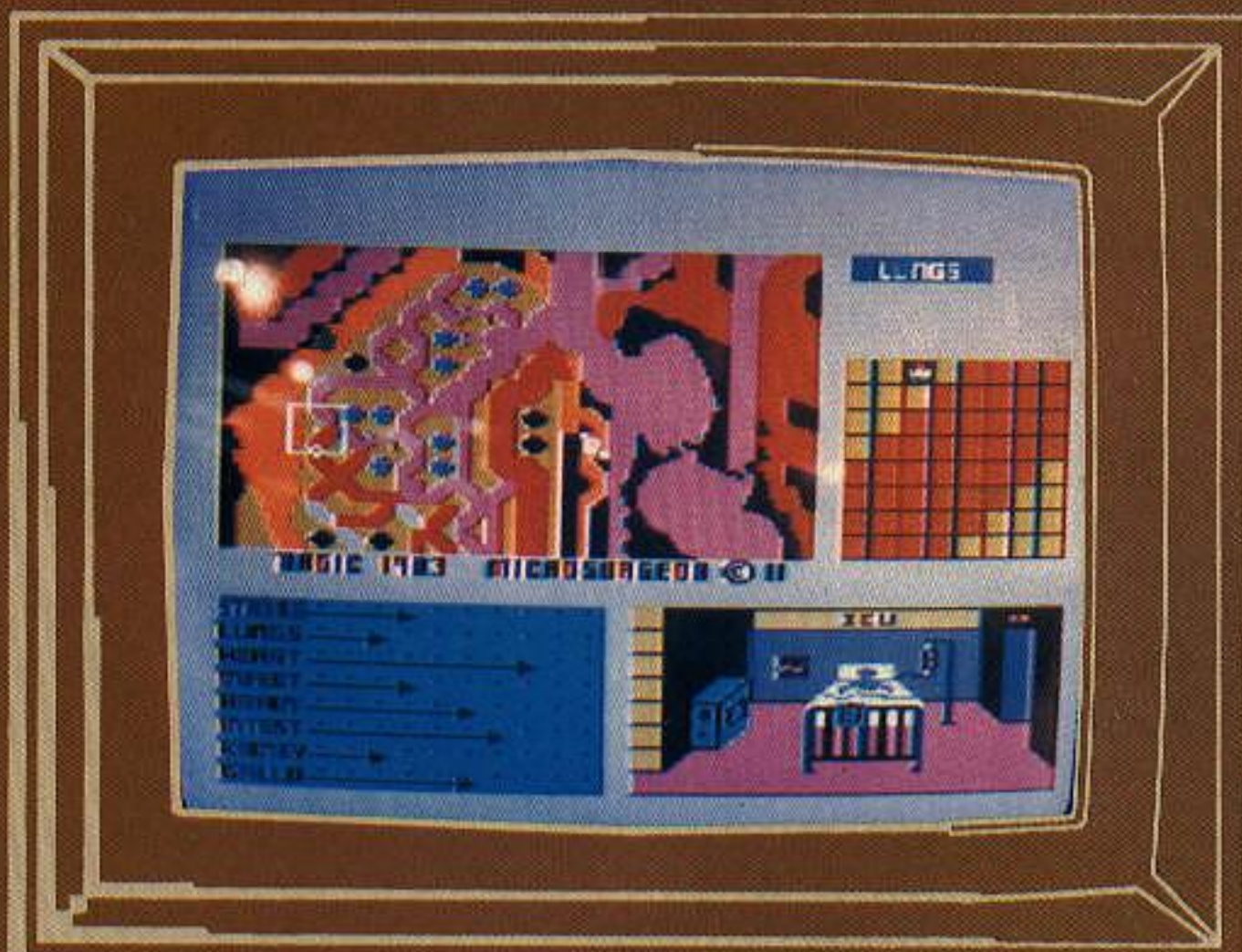
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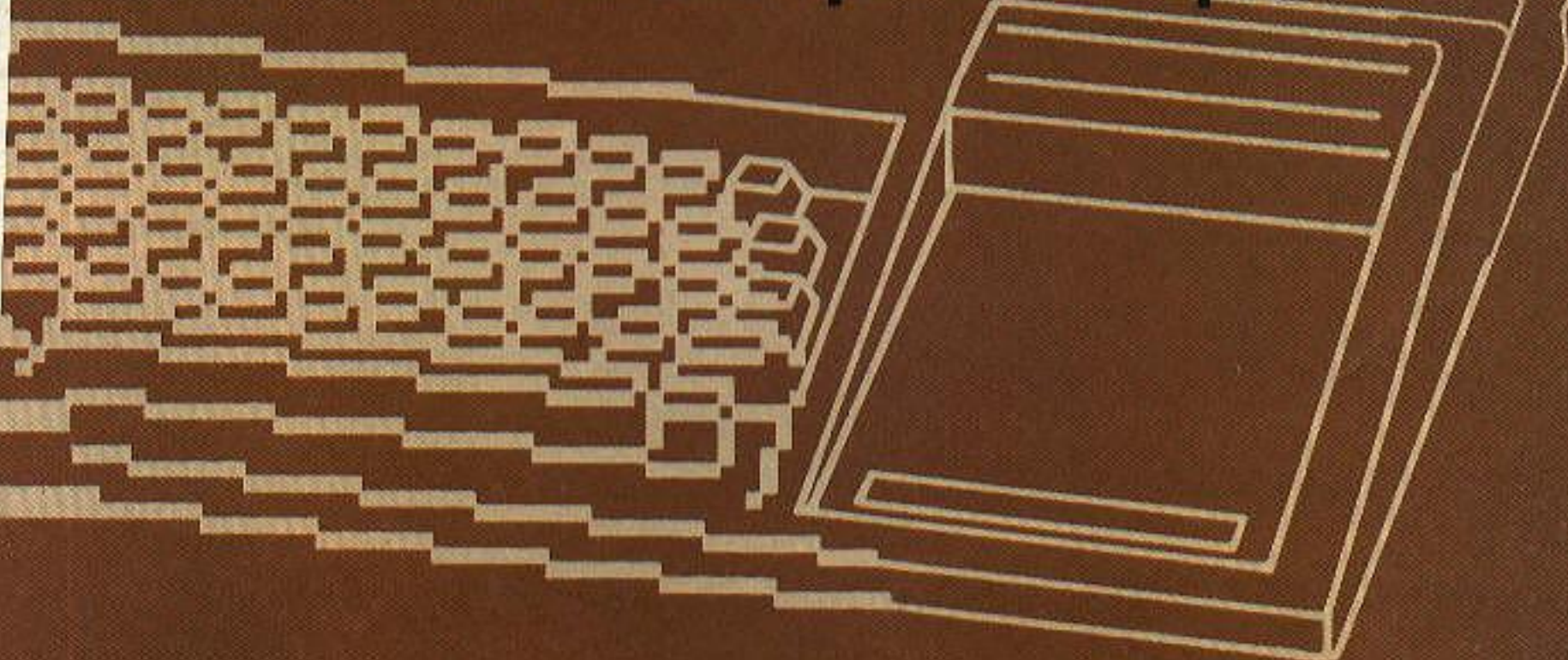
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ON SCREEN

By Gary M. Kaplan
Publisher & Editor-in-Chief



“The historians of tomorrow won’t have such an easy time pinpointing why the home computer world of the mid-80’s did what it did . . . ”

Perhaps the greatest impulse to trying to foresee and plan the future comes from the combination of having new tools with which to do it and the growing realization that every technological and social innovation has repercussions which spread like a wave through the complex interlocked sections of society.

—Ward Madden

Why are we all so fascinated by fortune tellers? Why is it that we can’t resist taking a peek at what is “just around the next bend?” And what fuels this universal obsession with predicting the future? For some, of course, it’s merely a matter of curiosity; for others, it means not wasting a significant chunk of sightseeing time on that finite trip we call “life”; and for the rest, it can mean economic gain and (it is hoped) a more pleasurable life.

With all the sophistication of the computer industry and the large corporations that dominate it, one would think that the awesome resources available for reasoning and prognostication based on serious market research would have reduced the art of fortune telling to a science by now. One couldn’t be farther from the truth. . .

It’s still very much a cybernetic carnival out there, with plenty of silicon gypsies gazing into their expensive crystal balls in search of elusive trends. In the old, familiar carny game, finding which shell the pea is under has been replaced by guessing where the next hot product will come from. . . and guessing the fat lady’s weight has been reduced, in corporate terms, to estimating the quarterly profits of the industry heavyweights—the home computer fabricators. For all the industry’s number-crunching power it is still no better than the old, wizened, mysterious lady in the tent: We all “pay our money and take our chances.”

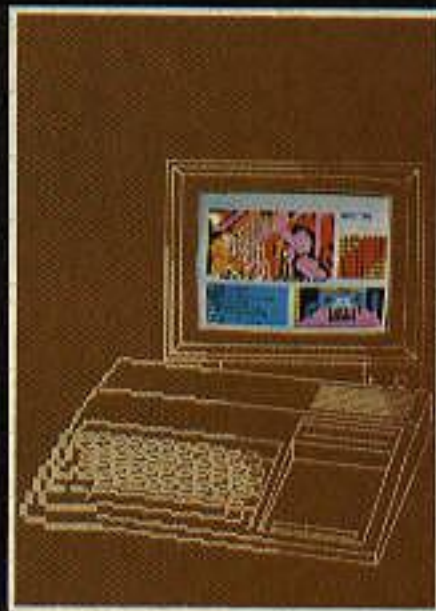
Hardly a day passes without a telephone call from some reporter, advertiser, or reader wanting to hear my predictions of industry trends. With so much “gloom and doom” media verbiage these days, concern for the immediate future seems to have intensified. So I thought it appropriate this month to don my best oracle robes and air my observations in the hope that—in the best Delphic tradition—I can shed some light on an industry that is doing its best to defy prediction.

Allow me to start with an observation: There are truths, and there are trends. . . and the first truth is that the strategy of reacting to “trends” is no longer a useful one in the home computer world. For with the foreshortening of successive product life cycles (at a rate alarming to manufacturers), there’s not enough time for the traditional market testing, product refinement, production tool-up, and marketing campaigns that have been the standard procedures for product introduction in other, more mature industries. In this fast-paced, electronic coliseum—characterized by rapid technological advances and product obsolescence battling it out with attempts at standardization and intense competition for shelf space and market share—trends just don’t stay around long enough to prevail.

Rather, I expect to see our traditional concept of “trends” become outdated because of seesawing consumer confusion in the face of too much choice. The marketing seer’s favorite buzzword, “segmentation,” will, in all likelihood, become “fragmentation” until more market and industry maturity sets in. The Pet Rocks and Hula Hoops of yesteryear have already secured their place in the marketing history books; but the historians of tomorrow won’t have such an easy time pinpointing why the home computer world of the mid-80’s did what it did. . .

As consumers, you can expect to be subjected to a cornucopia of new products that will be born and die, in rhythm with the waxing and waning of a product’s technological superiority. The technology and products affected will include: (1) program and data storage media; (2) input/output peripherals featuring refinements in speech, optical, and motion recognition, exotic displays, and robotic devices; (3) interfaces of video and computer devices depicting more spectacular “real-life” experiences for entertainment, education, and productivity applications; (4) large amounts of affordable memory, allowing more sophisticated and time-dependent applications; (5) low-power and non-volatile semiconductor devices for more interplay of choice and convenience in a mobile, multi-use work/play world; (6) faster data communications devices; and (7) local area networks for each neighborhood to share and access huge data pools and raw computing power.

In future columns, we’ll explore the state-of-the-art in some of these areas. So stay along for the ride. And if you just can’t resist the temptation to isolate trends and make predictions, pay attention to what our “99’er Digest” (see p. 36) prognosticators have to say in each issue.



99'er HOME COMPUTER magazine

To paraphrase a familiar line: "A graphic journey of great imagination begins with but a single pixel." The microcomputer visual effects which grace our cover this month depict this stunning evolution. Graphics has come a long way—from the block graphics approximations of lines on the left side of the console, through the fine-line graphics of the right side, to the bit-map graphics and windowing techniques of the program on the screen. Unlike the suffering patient in *Microsurgeon*, the body and soul of computer graphics are bursting with life and energy. In fact, if a cathode ray tube could talk to those responsible for creating these new celebrations of color, it might very well glow with gratitude and say, "Ah... Let there be light!"

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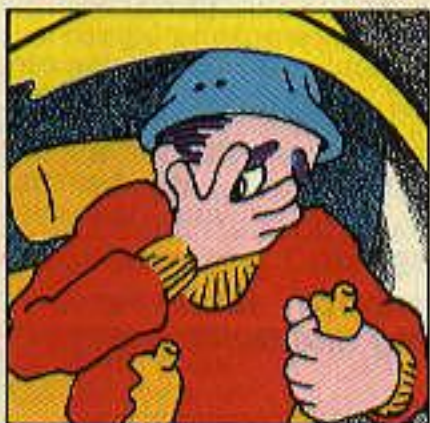
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99'er HOME COMPUTER magazine

99'er Home Computer Magazine (ISSN 0279-1927) is published monthly by Emerald Valley Publishing Co., P.O. Box 5537, Eugene, OR 97405. The editorial office is located at 1500 Valley River Drive, Suite 250, Eugene, OR 97401. (Tel. 503-485-8796). Subscription rates in U.S. and its possessions are \$25 for one year, \$45 for two years, and \$63 for three years. In Canada and Mexico add \$7 per year. Other foreign countries \$43 for one year surface mail. Inquire for air delivery. Single copy price in U.S. and its possessions is \$3.50, and \$4.00 in Canada and Mexico. Foreign subscription payment should be in United States funds drawn on a U.S. bank. Second-class postage paid at Eugene, OR 97401. **POSTMASTER:** Send address changes to **99'er Home Computer Magazine**, P.O. Box 5537, Eugene, OR 97405. Subscribers should send all correspondence about subscriptions to above address.

Address all editorial correspondence to the Editor at **99'er Home Computer Magazine**, 1500 Valley River Drive, Suite 250, Eugene, OR 97401. Unacceptable manuscripts will be returned if accompanied by sufficient first class postage and self-addressed envelope. Not responsible for lost manuscripts, photos, or program media. Opinions expressed by the authors are not necessarily those of **99'er Home Computer Magazine**. All mail directed to the "Letters to the Editor" column will be treated as unconditionally assigned for publication, copyright purposes, and use in any other publication or brochure, and are subject to **99'er Home Computer Magazine's** unrestricted right to edit and comment. **99'er Home Computer Magazine** assumes no liability for errors in articles or advertisements. Mention of products by trade name in editorial material or advertisements contained herein in no way constitutes endorsement of the product or products by **99'er Home Computer Magazine** or the publisher unless explicitly stated.

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INSIDE 99'er

A shot in the dark—that's what programming screen graphics used to be like. At first, just getting the screen to change color brought out goosebumps, but now that computer graphics has become an art form in its own right—with three-dimensional graphics, animation, and fluctuating spectrums—we can create sequined seas of living color. "Who's we?" Hop aboard our hydrofoil and you'll soon be a graphics revolutionary, leaving the less enlightened in your wake!

Of course there's no revolution without evolution, so in this issue you can bone up on a special kind of evolution in *Graphics Grow Up* to see how graphics have progressed from pixellation, through BASIC motion, to the shadow of your sprite! While sprites are nice, the ebb and flow of the computer graphics tide takes us beyond the stunning shores of sprites to *3-D Animation and the TMS9918A Video Chip* which makes these dazzling displays possible.

Now that you're graphically in the swim of things, join us for an in-depth look at the new wave of developments in hardware and software we discovered at the *Chicago Consumer Electronics Show*. We unveiled some exciting new products of our own... (Be on the lookout for our new 99'er-Ware rainbow logo—your sign of quality, trend-setting software). Our photographic tour of this show will give you the advance information you'll need to fathom the oceans of innovations that everyone will soon be talking about.

Printing, not talking, is the focus of *JoyTalk, Pt. II*. All of you who took the plunge and constructed the hardware that converts your joystick port into a low-cost printer interface will find all the hook-up-and-go information necessary (including a ready-to-run program) for smooth sailing on your maiden voyage.

Before we set sail, however, let's chart our course with the help of our *Multiplan Medium*. This month our savvy soothsayer tells how to use *Multiplan's* helpful editing features so that a careless keystroke won't cause a catastrophe.

Ready to weigh anchor? If you are worried that seasickness might put you under the weather, get help in *Never Out Of Sorts*. This article, with its BASIC programs, explains and compares five sorting algorithms that will let you organize data with aplomb.

A peach of a teaching aide comes to us in *By George You've Got It*. This flexible BASIC program not only helps to conquer spelling demons, it can be your foreign language tutor!

Let's talk turtle for a moment with the *Logo Logician* who will be visiting us periodically. This inaugural installment includes procedures for modeling alternatives in this versatile language. Those of you who still doubt LOGO's potential should feast your eyes on its graphics power displayed in *Mosaic Designs*. This kaleidoscope of color and texture is the spectacular solution to one of the LOGO challenges flung on our doorstep.

We go now from the intriguing LOGO designs on our small screen to exciting intrigue on the "big silver screen." Get your popcorn and soda pop, and settle back for our multimedia review of *War Games*. Or, perhaps you'd rather curl up with a good book. Our review of *Learn BASIC: A Guide to Programming the Compact Computer 40* may be just the escape you've been looking for.

Escape you may, or bargain you must when the greedy pirate catches you with your awesome bounty in our Extended BASIC game, *Treasure Island*. Or, perhaps the mental challenge of the colorful *Switch-A Row*, in console BASIC, will strike your fancy.

No matter what your taste, whether you like your graphics fancy and full of flourishes or plain and profound, July's special attractions and regular features boldly state: "Color the future of computer graphics bright and beautiful." It looks like our shot in the dark has become a fireworks display that will light up the skies as we navigate our way into this graphics revolution. It's good to have you aboard!

Until next month, have fun reading, learning and RUNing 99'er

Send in Your Photos and Anecdotes

Do you have a favorite photograph (color or black and white) featuring an unusual application of your Home Computer? Would you like to share your unusual or amusing anecdotes relevant to Home Computing? *99'er Home Computer Magazine* will pay \$25 for items it publishes. Material chosen will be subject to the same copyright treatment as "Letters to the Editor" as set forth on the Masthead page. No submissions can be returned. Send anecdotes and copies of photos to: Potpourri Editor, 99'er Home Computer Magazine, 1500 Valley River Drive, Suite 250, Eugene, Oregon 97401.

LETTERS TO THE EDITOR

Dear Sir:

I think your magazine is great and hope you keep running more great games. But I have a problem with *Lost Ruins*: When I hook up my joystick it doesn't move the robot at all. When I push [FCTN] [E] (A) on my computer, he moves to the left instead of up. Can anybody help me solve this problem?

Scott Wyatt
Lones Park, IL

Lack of response to the joystick can have one of two causes. By far the most common is forgetting to put the [ALPHA LOCK] key up. So for games, remember: [ALPHA LOCK] UP! Occasionally you will find a joystick which is not compatible with the TI-99/4A.

Your second problem is most likely due to an error in entering the program. Although it is very tedious work, you have to go through the program line by line, character by character, to find these typing errors. Sometimes they can be devilishly hard to find because we want the lines to be right—we know they're right—and that mindset causes us to overlook the error.

Dear Sir:

I have some observations I would like to make about the article *Fulfilling Untapped Potential* in your May issue. Mr. Jenkins, the author, did an excellent job describing applications of computers to individuals with learning disabilities. He also touched on the idea that while there is not an abundance of software available for these individuals, some of the software designed for children may be applicable.

I would like to elaborate on this point only in the reverse. That is, some of the software designed for individuals with learning disabilities are also quite valuable learning tools for children. I have a four-year-old son, and much of the software that I own is educational in nature and for his age group. While he does enjoy some of the command modules (most notably *Early Learning Fun*), his favorite group of software has been that developed by Mr. Jenkins for individuals with learning disabilities. In fact, he has learned to count and do basic elementary math through these programs. They are written in a challenging, yet game-like format which makes it fun to learn. He would rather "play" with these learning programs than with the likes of *Munchman* or *Parsec*.

Bill Wietes
Marshfield, WI

As Bill attests, well-designed educational software can be as fun and challenging as some of the most entertaining games. And it can make learning a less painful process.

Dear Sir,

I would like the opportunity, as a recent subscriber to your magazine, to let you know how much I enjoy your excellent publication. It is far superior to the many multi-computer magazines which tend to ignore or underrepresent the 99/4A despite its vast sales during the last year.

There is one question I would like to ask you about the TI Chess module. Since I do not know anyone who has one, I am at a loss to determine whether it is any good or not, and consequently I am unwilling to spend between \$50 and \$70 to evaluate its performance. I have toyed around with it in a department store and admit that its graphics and variations seem to be excellent. However, a serious chess player needs a program which will be able to defeat a human opponent on occasion at advanced levels. I own an Atari 2600 and I am impressed with its chess cartridge at levels 6 & 7. I can normally beat it at level 6, but do not have the patience at level 7 to wait an average of 10 hours for it to move. Since the TI cartridge has 48K of memory (much more than the Atari) does this mean that it is better at the most advanced level, taking about three minutes to move compared with about ten hours for the Atari? After all, the Atari has such a limited memory that it cannot display the board while it is thinking about a move.

Alec McKay
Lansdowne, PA

In the Computer Chess Corner (Vol. 1, No. 1, of 99'er HCM), Jerry Wolfe wrote of TI's Video Chess cartridge: "Based on many years of tournament experience, I would estimate the maximum strength of the program to be slightly less than the average player in a typical chess tournament. This is superior to probably 90 percent of the world's chess players." That may give you some idea how you and Video Chess might fare in a match. When it comes to time, you can control the responses by allotting both players—you and the computer—from 30 to 200 seconds each, exactly as in a tournament where clocks are mandatory. Wolfe did write that in the problem-solving mode, the computer exhausted his patience after taking two and a half hours without solving the problem.

Dear Sir:

I am a student at Pine Valley Central School. In my Advanced Science Class, I have been working with the Texas Instruments TI-99/4A computer.

In the programs I have been typing on the computer I have had to use the plus sign, the shift key and the equals sign key. A limited daily use period (45 minutes) often rushes me for time. In haste I often press the function key instead of the shift key because they are so close together on the keyboard. When I do this the quit function erases the work before I get a chance to save my program on tape.

Assuming that I'm not the only one who has had this problem, I suggest that the computer keyboard be redesigned to compensate for this problem.

Norman Austin
South Dakota, NY

We make the same mistake now and then ourselves—as recently as Tuesday morning, for instance—and we also find it vexing. Norman, Texas Instruments is well aware of this inconvenience, and its newer computer designs will undoubtedly have the [SHIFT], [FCTN] and [ENTER] keys separated. The new Compact Computer CC-40 is one recent example.

Dear Sir:

Thank you for being the only publication that seriously discusses the TI-99/4A.

A lot of third party hardware is appearing: Foundation's 128K memory, other 32K memory, half-height disks for mounting 2 disks in the Expansion box, RS232 peripherals, the "Joyprint" RS232 adapter and the MYARC hard disk, etc. I would greatly appreciate a technical evaluation of these items, telling me how user friendly they are, what features they have compared to similar TI hardware, what limitations they may create, etc.

John P. Hunt
Roslyn, PA

We've reviewed hardware in the past, John, and we'll continue to review hardware periodically. We covered printers in February of this year, for instance, and in September we'll carry a review of add-on memory devices, as well as a survey of software, peripherals and accessories.

Continued on p. 60

Entering 99'er Programs

New readers should be aware that within the magazine's pages are found actual computer programs that you can put into your Home Computer and enjoy.

Make sure you have any special system components required by the program (e.g., the Speech Synthesizer, Extended BASIC cartridge, etc.). Then, using the console keyboard, you can type the printed

magazine listing (character for character, and line by line) into the computer's memory.

Before entering the program, connect a cassette recorder to the computer. Make sure you have two blank cassette tapes. For each 10-20 lines you type in, use SAVE CS1 to save that program segment onto one of the tapes. Alternate between the two tapes each time you save the program. Be sure to rewind to the beginning of each

tape before saving, so that you always record over and replace the shorter segment of program lines with the longer segment. By following this procedure, you'll always retain most of your work even if the lights go out or someone turns off the computer.

Double check your typing against the program listing for errors, and then have someone else check it. The most common errors are typing the letter "O" instead of the number "0" (zero)—they are not interchangeable to the computer. This is also true for the letters "I" and "L" and number "1" (one). See "Key-In Reference"

Every time you make a correction to your program, SAVE CS1 and switch the tapes. Once all the errors are corrected, you will have a good copy of the program on the last tape. Before turning off the computer, put the other cassette tape in your recorder and once again SAVE CS1. Now, if one tape gets damaged, you won't have to enter the program listing via the keyboard all over again. Have fun and happy computing.

99'er

Programming Conventions

KEY-IN REFERENCE

123456789 ABCDEF GHIJ KLMNOPQRST UVWXYZ+) (= *% ^ \$ # @ ! - / " ' ? _ [\ ~ : ; } { | \ ^ < , > . 0 1

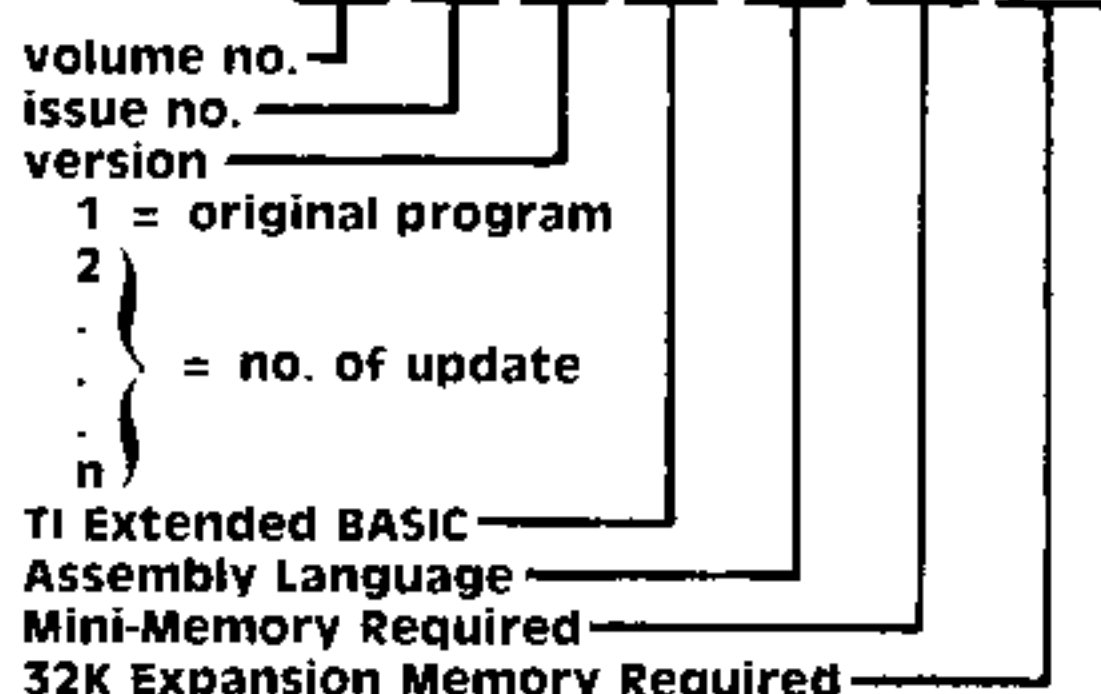
99'er = End of Program or Article

compu-prestidigitation

(kóm-pū-prēs-teh-dī-jeh-tā-shūn) - n. 1. The magical quality of unexpected comprehension that results from presenting technical information about computers in a lively, entertaining, visually attractive and easy-to-understand format. 2. The magical tricks that make a computer sing, dance, and do all sorts of wonderfully useful things.

99'ER VERSION

2 . 9 . 1 . XB AL MM EM



By W. K. Balthrop

GRAPHICS

If I were to try to outline the complete evolution of computer graphics, I could easily fill an entire volume. There have been so many changes and advances in computer technology in just the last few years that even the "computer nut" finds it impossible to keep up. Even where the technology has changed little or not at all, the quality of graphics has improved as the knowledge of programming techniques has spread to more and more people. This has certainly been the case with the TI-99/4A.

Graphics on the TI-99/4A have evolved in the last few years from what are now considered very simple effects to very complex bit-image displays. The graphics capabilities of the TMS9918A video processor have also opened a new world of visual possibilities (see adjoining sidebar). The screen photos shown here demonstrate the present state of the art in Home Computer game displays.

In the last few years, the number of knowledgeable computer users has increased substantially. With the help of users groups and this magazine, programming enthusiasts are learning to squeeze as much out of the system as they can. And by no means have they gotten it all! In the next few years we will see even greater breakthroughs in the quality of graphics as we explore this wonderful new visual world.

In The Beginning

A long, long time ago—about two and a half years ago—I bought my first TI-99/4 Home Computer. On sale for \$900, it was a bargain. Even then TI had incorporated graphics-enhancing features which the other companies were just beginning to think about. But very few people knew how to make full use of those capabilities.

In the beginning, TI-99/4 programmers were satisfied to use techniques they had learned on other computers. But the BASIC programming language which came in every console was a powerful graphics tool. Users could create 128 separate graphics characters, and give the 16 groups (of 8 characters each) any two of sixteen available colors. With this capability, an infinite number of effects could be accomplished with very little programming effort. The 99/4 also had new commands to work with, such as CALL HCHAR and CALL VCHAR, which let users place the graphics anywhere on the screen without having to worry about memory addresses. All the user needed to supply were the X and Y screen coordinates. These two commands were, however, even more potent than most people realized, in that they permitted one statement to repeat the character as many times as necessary, either horizontally or vertically. These powerful commands made it very easy to draw borders around the screen or display grids of characters, and saved enormous amounts of time and program space.



M*A*S*H



BASEBALL

BASIC Motion

Once the graphics characters were on the screen, many computer novices were at a loss as to how to move them around. It's really quite simple once you have a good understanding of the BASIC commands. The first program listing, which I call *Basic Motion*, will show you how to create a graphics character, place it on the screen, and then move it around with either the four arrow keys on the keyboard or the joystick. In addition, you will be able to change the character's color at any time by pressing either [ENTER] or the joystick's fire button. This program is not a complete game in itself, but you can use it in a game of your own or incorporate parts of it in other programs.

You can program each of the 128 characters in the system to take on any shape you desire. Each character is made up of 64 pixels, which are single dots of color at the finest resolution on the screen. When combined in 8x8 arrays, these dots make up the characters on your screen. You have the power to turn any one of these 64 pixels off or on in any of the 128 characters.

In BASIC, the characters are numbered from 32 to 159. If you want to change the pattern of the character which normally displays the letter "A," you use a statement like this:

```
CALL CHAR(65,"1818087E5A5A2442")
```

The number 65 is the ASCII code for the character containing letter "A" and tells the computer the character it is to work

with. The numbers and letters following the comma in the statement tell the computer how to define a new pattern. The computer uses a numbering system called *hexadecimal*, or a *base 16* system. This is like saying the computer has 16 fingers on its hands instead of 10. When the computer reaches 9, it needs something to represent those other fingers, so it uses the first 6 letters of the alphabet. Thus, the computer reads the expression in quotes as a hexadecimal number. In *Basic Motion*, the statement in line 230 creates a new character where the letter "A" used to be. Now whenever you tell the computer to place the letter "A" on the screen, this new character will appear.

In line 260 the CALL COLOR statement is used to give the character a color. If you look in your manual, you will find that the letter "A" (ASCII code 65) is in color group #5. You can assign each color group (consisting of eight characters) a foreground color and a background color. Here the foreground (those pixels I turned on) is set to light blue, and the background is set to transparent, which means it will change to whichever color the screen is set to. Finally, in line 300, CALL HCHAR places the character on the screen. Here I need to supply only the X and Y coordinates and the ASCII code for the character I want to display. In lines 170 to 220, you need to decide whether or not to use joysticks. This choice will set a variable, J, to 1 if you want to use joysticks or 0 if you want to use the keyboard. Line 310 checks the

Continued on p. 12

GROWS UP



SPRITES IN DEPTH



MICROSURGEON (above)



MOONMINE (above right)

Above Left— The moving shadows of helicopters, baseballs and airplanes, all created by sprites, make screen displays more realistic by simulating depth. *M*A*S*H* (from Fox Video) and *Baseball* (from Milton Bradley) are to be manufactured and distributed by Texas Instruments.

Above Right— *Microsurgeon*, (from Imagic), depicts the human anatomy in detail, and utilizes an impressive "windowing" technique. This educational game is already being used as a teaching tool on game machines, and will be manufactured and distributed for the Home Computer (as shown here) by TI. *Moonmine* (from Texas Instruments) is a new 3-D space mining game. It has interrupt-driven speech and motion for a more realistic impact. *David's Midnight Magic* (from Broderbund Software) conveys all the excitement of the mechanical pinball machine in an electronic form. As seen here on an Apple II, it will be produced and distributed for the 99/4A by TI.



DAVID'S MIDNIGHT MAGIC

3-D ANIMATION WITH THE TMS9918A VIDEO CHIP

Until fairly recently, computer displays have usually been implemented through software from the corps of highly-trained professional programmers who devise the codes to control graphics. But in order for visual artists with little programming knowledge to interact directly with the display, other implementations are necessary. For its 99/4A, Texas Instruments has devised such a means. This computer has a video display processor (VDP) chip, which makes the graphics display commands an integral part of the hardware. With most of the graphics display information already in the hardware, fewer commands from the users are needed to generate graphics. Now, even novice computer users can readily control TI's smoothly moving graphics patterns, universally known as *sprites*.

A Flat, Yet 3-D Sandwich

The VDP wonder-chip responsible for sprites and other video effects on the 99/4A is the TMS9918A. This large-scale, integrated-circuit (LSI) chip represents the next generation

beyond the many small- and medium-scale integrated circuits that once had to be combined to achieve a display with a minimal level of resolution. But TI's chip provides a novel approach to the dramatic simulation of three-dimensional graphics displays: It creates nearly three dozen flat, "stacked" geometric planes, sandwiched one on top of the other in the picture tube of your TV or color monitor.

On each of the first 32 planes (numbered 0 to 31), we can define the image of one sprite, give it one of the 15 standard colors (the 16th is transparent), and then set it in motion quickly and smoothly. We do not have to define the same imagery repeatedly to simulate motion because once set in motion, a sprite can continue to move without further program control. When a sprite on a lower numbered plane (closer in the foreground) comes into contact with another sprite on a higher numbered plane, it blots the second one out, creating the illusion that it passes in front of it.

The Multicolor or Pattern Plane is used for textual and fixed-graphics images. It is essentially the scenery that the sprites on

Continued on p. 12



For everyone who's tried
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Who knows graphics better than Epson?

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With a 12K ROM capacity, the FX-80 gives you a few things the others don't. For example, not one, not two, but *seven* different dot addressable graphic modes are program

selectable. And can be mixed in the same print line. Everything from 72 DPI (dots-per-inch) Plotter Graphics to the 640 dots per line resolution designed to match the remarkable monitor clarity of the Epson QX-10 personal computer.

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The FX-80 has all the hardware features you've come to know and love on the MX Series: logic seeking, bidirectional printing, the by-now-famous disposable printhead, and more.

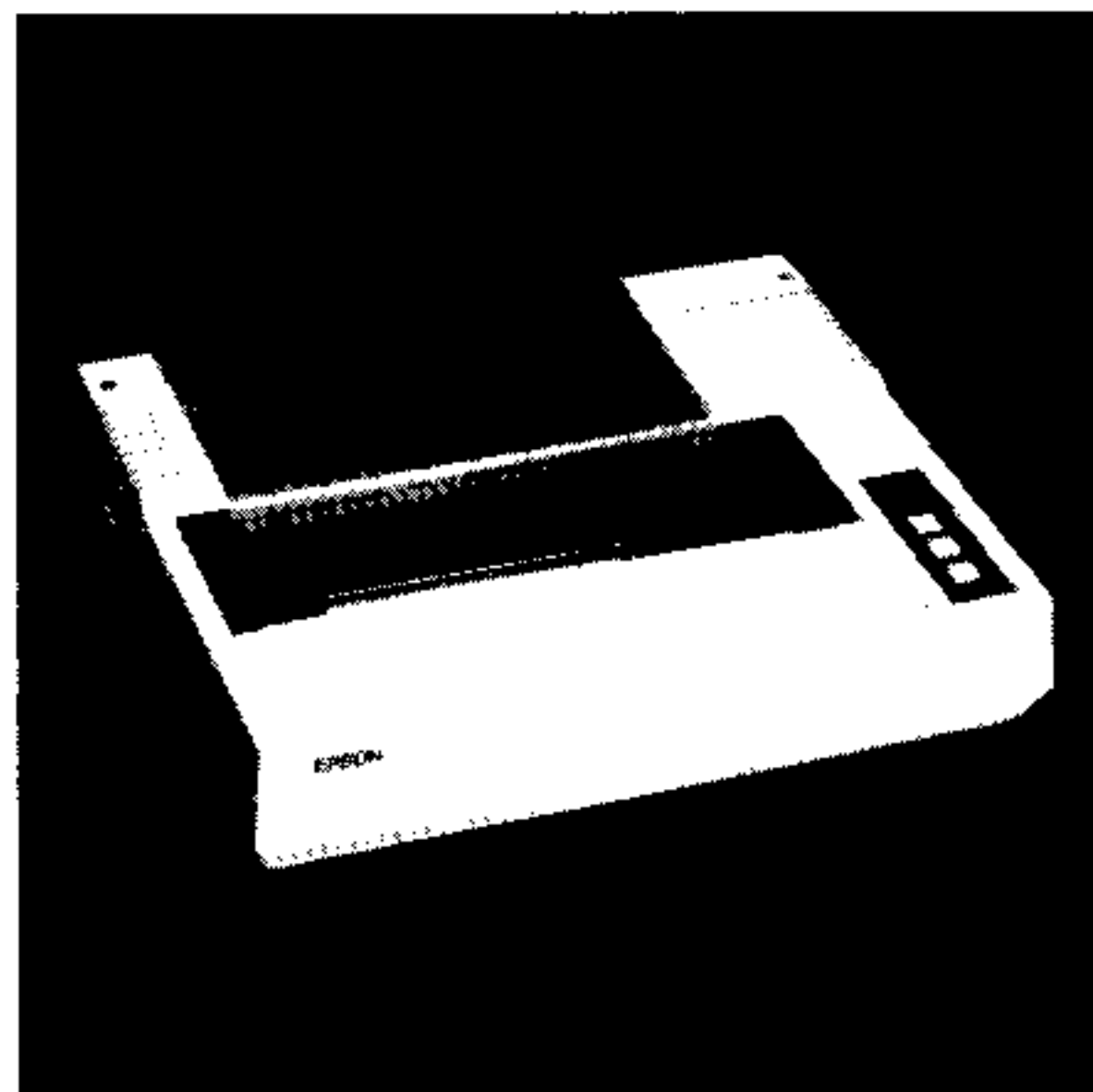
The FX-80 features an adjustable pin platen or optional friction/tractor feed, so you can use fanfold, roll or sheet paper ... backwards or forwards. The FX-80 even gives you reverse paper feed.

And if you're printing forms, the FX-80 has a feature you're gonna love: a function that allows you to tear off the paper within one inch of the last print position.

Be the first on your block.

We'd be willing to bet that the FX-80 — like the MX-80 — will have its share of imitators. Don't be fooled. To make sure you get the genuine article, rush down to your local computer store right now and let them show you everything the FX-80 can do.

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Graphics ... from p. 8

value of J and branches to the joystick routine if J equals 1. Lines 320 to 390 contain the keyboard logic. This part of the program reads the keyboard, checks the value of the key pressed, and then branches to the appropriate subroutine to move the character on the screen or change its color.

Lines 400 to 460 contain the joystick logic. Here joystick #1 is read, and the X and Y position of the stick is placed in variables JX and JY. Line 410 calculates a number from 1 to 9, based on the position of the joystick, which line 420 uses to branch to the appropriate subroutine. A CALL KEY statement (line 430) then checks the left-hand side of the keyboard to detect whether or not the fire button from joystick #1 has been pressed. It does this by placing 1 in the first variable position of the CALL KEY variables (which checks the left-hand side of the keyboard) and by checking for character number 18 in the second variable position.

The remainder of the program contains the routines for moving the character across the screen and changing its color. I will describe one of the movement

subroutines and the color routine. The remaining movement routines are identical to the first except in the direction of movement.

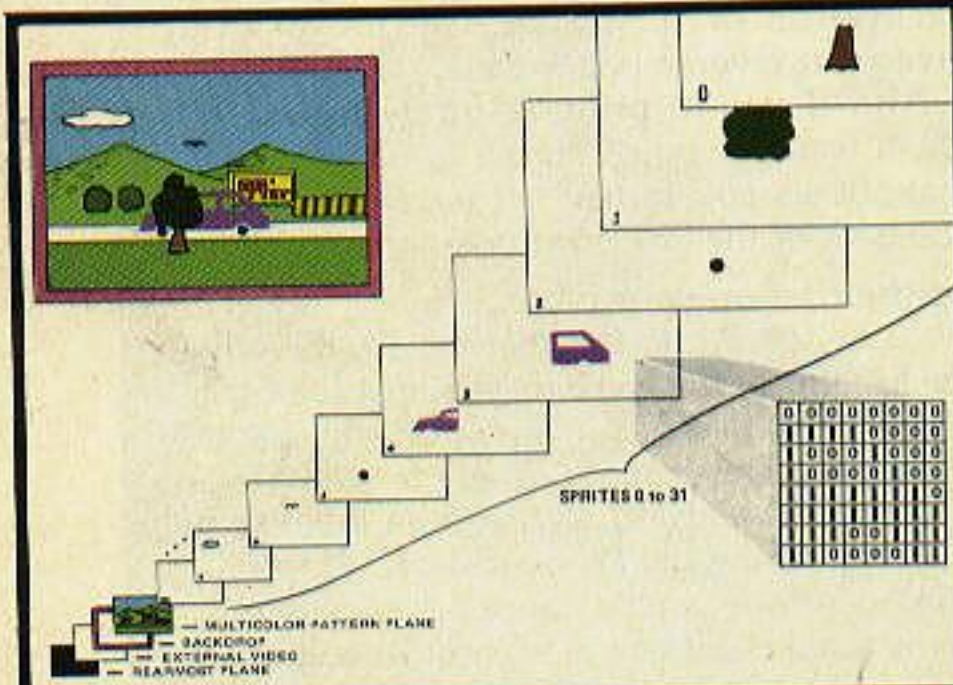
Lines 450 through 550 will cause the character on the screen to move upward. Line 470 decrements the variable which keeps track of the vertical screen position. Lines 480 to 520 check to see if the character has moved off the top of the screen. If it has, they change the variable to indicate the bottom of the screen, and line 510 then places the character at the bottom of the screen. This is called "wrapping." Because both the keyboard and the joystick-controlling logic use these routines, a check is made in line 520 to determine which of them is being used so that the program can return to the proper section. Lines 530 to 550 handle the character when wrapping around the screen is not needed. Line 530 will place the character in its new position. The old character is then taken off the screen in line 540. Line 550 is identical to line 520. Lines 830 to 870 will change the color of the character. The key variable here is COL, which keeps track of the character's color and is used in the CALL COLOR statement in line 860.

```

100 REM *****
110 REM * BASIC MOTION *
120 REM *****
130 REM BY W. K. BALTHROP
140 REM 99'ER VERSION 2.9.1
150 REM
160 CALL CLEAR
170 INPUT "DO YOU HAVE JOYSTICKS?"
180 IF (J#="Y")+(J#="y") THEN 220
190 IF (J#<>"N")*(J#<>"n") THEN 170
200 J=0
210 GOTO 230
220 J=1
230 CALL CHAR(96,"1818087E5A5A2442")
240 CALL CLEAR
250 CALL SCREEN(2)
260 CALL COLOR(9,6,1)
270 X=12
280 Y=16
290 COL=6
300 CALL HCHAR(X,Y,96)
310 IF J=1 THEN 400
320 CALL KEY(0,K,S)
330 IF S=0 THEN 320
340 IF K=67 THEN 470
350 IF K=83 THEN 560
360 IF K=68 THEN 650
370 IF K=88 THEN 740
380 IF K=13 THEN 830
390 GOTO 320
400 CALL JOYST(1,JX,JY)
410 JZ=((JX+38JY)/4)+5
420 ON JZ GOTO 430,740,430,560,430,
,650,430,470,430

```

Continued on p. 14



In the figure shown here, the moving car (composed of four sprites set in motion together on plane numbers 2-5) will pass *behind* the stationary tree (composed of 2 sprites on planes numbers 0 and 1), and *in front* of the billboard which is drawn on the plane immediately behind the rear-most (number 31) sprite plane. By the same design rules, the cloud (plane 7) will mask the color of the sky behind it, and a bird (plane 6) will both mask the sky behind and appear to fly *in front* of the cloud. And since sprites move in a transparent surrounding, the scenery in the background behind the car may be seen *through* the "windows" of the moving vehicle! The entire scene has the appearance of depth and is very like a 3-D animated color movie.

the remaining 32 planes appear to pass directly in front of. Immediately behind the Multicolor Plane is the Backdrop Plane—solid-colored and slightly larger than the other 33 planes in front of it, so that it forms a rectangular rim around the other elements on the display. The rearmost plane is pure black, so that when the other planes are set to transparent, the screen appears to be black.

Those Magical Sprites

When sprites are on the screen, the 9918A chip organizes the display into a high resolution pattern of 256 by 192 little boxes or picture elements called "pixels"—the smallest controllable elements on the display. Each one of these 49,152 pixels

represents a possible address for a sprite to reside at, or pass through when moving across the screen.

The shape of a regular or standard sprite is defined by an 8 × 8-bit pattern stored in memory. Each of these 64 bits corresponds to one of the 49,152 screen pixels mentioned previously. Each is a single color when the bit pattern contains a 1 (and is thereby "turned on") or is transparent when the bit pattern is "turned off" by a 0 designation. We can specify a larger sprite by either: (a) using a 16 × 16 bit pattern ("a double-sized unmagnified sprite"), (b) magnifying the existing sprite by a factor of four ("single-sized magnified"), or (c) using both techniques together to create a sprite sixteen times normal size ("double-sized and magnified"). This size feature allows screen objects to grow and shrink at will—with virtually *none* of the programming effort that would be required in more conventional VDP systems.

Each sprite carries four attributes: The first two specify its horizontal and vertical position, the third defines its shape "name" (according to the bit-pattern concept described above), and the fourth specifies its color. Moving a sprite is simply a matter of changing its position indicators; it will continue moving smoothly on its own. The high-speed, smooth motion of a sprite (as opposed to a conventional moving-graphic element) is due to the smaller, more precise "steps" (higher resolution) that the sprite can take while moving.

The TMS9918A VDP chip has four modes of operation: (1) Graphics 1 or Pattern Mode, (2) Graphics 2 or Bit-Map Mode, (3) Text Mode, and (4) Multicolor Mode. The Pattern Mode consists of a 32-column by 24-row grid of 8 × 8 pixels in each 2-color grid square. Bit-Map Mode allows each of the 8 horizontal rows within an 8 × 8 grid square to have 2 *unique* colors. In Text Mode the screen is a 2-color *single* plane (so sprites aren't available) of 40 columns by 24 rows composed of 6 × 8 grid squares. This allows an ASCII character set with each character formed from a 5 × 7 pixel grid, and 2 pixels between characters and rows. Multicolor Mode divides the pattern plane into an unrestricted 64-column by 48-row color-square display, with each 4 × 4 pixel square allowed to take on any of the 15 colors or become transparent. —Gary M. Kaplan

This piece originally ran as part of a larger article in Volume 1, Number 6, of 99'er Magazine. We suggest you refer to this issue for an explanation of graphics with a bit-mapping technique.

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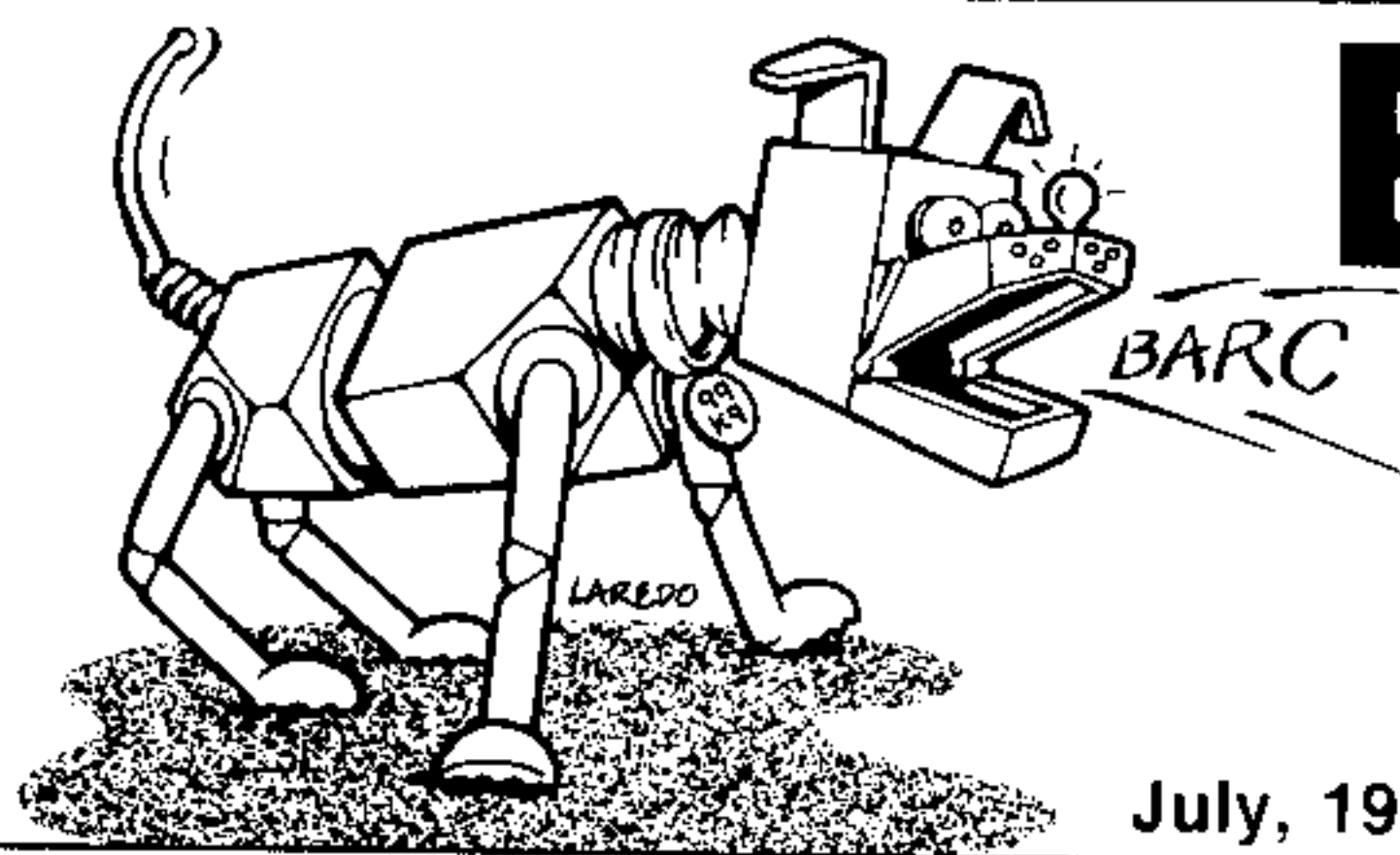
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B.A.R.C.* BACK

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☐ 27	Switch-a-Row
☐ 29	By George, You've Got It!

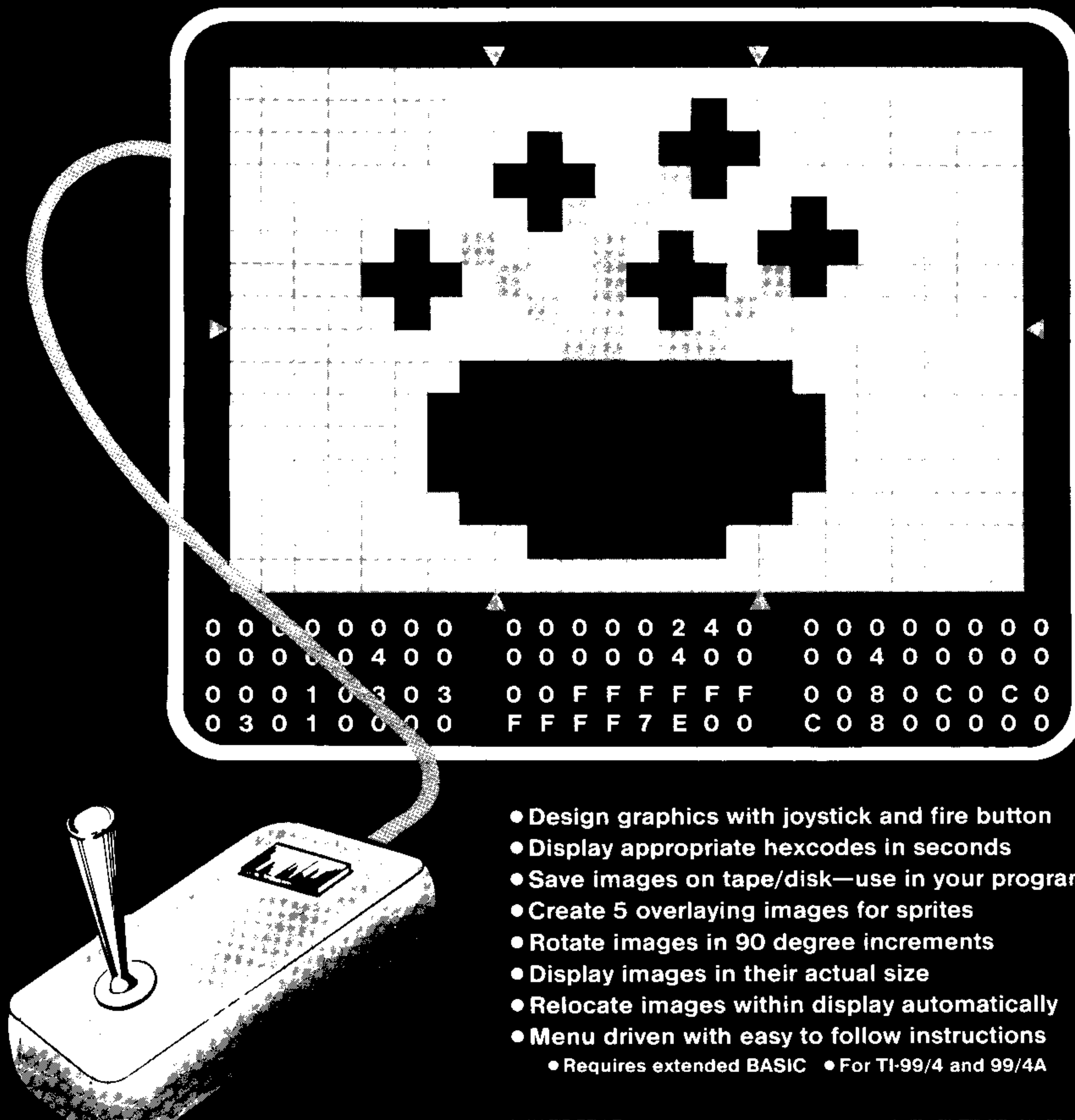
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Graphics ... from p. 12

```

430 CALL KEY(1,K,B)
440 IF K<>1B THEN 400
450 K=0
460 GOTO 830
470 X=X-1
480 IF X>0 THEN 530
490 CALL HCHAR(X+1,Y,32)
500 X=24
510 CALL HCHAR(X,Y,96)
520 IF J=1 THEN 430 ELSE 320
530 CALL HCHAR(X,Y,96)
540 CALL HCHAR(X+1,Y,32)
550 IF J=1 THEN 430 ELSE 320
560 Y=Y-1
570 IF Y>0 THEN 620
580 CALL HCHAR(X,Y+1,32)
590 Y=32
600 CALL HCHAR(X,Y,96)
610 IF J=1 THEN 430 ELSE 320
620 CALL HCHAR(X,Y,96)
630 CALL HCHAR(X,Y+1,32)
640 IF J=1 THEN 430 ELSE 320
650 Y=Y+1
660 IF Y<33 THEN 710
670 CALL HCHAR(X,Y-1,32)
680 Y=1
690 CALL HCHAR(X,Y,96)
700 IF J=1 THEN 430 ELSE 320
710 CALL HCHAR(X,Y,96)
720 CALL HCHAR(X,Y-1,32)
730 IF J=1 THEN 430 ELSE 320
740 X=X+1
750 IF X<25 THEN 800
760 CALL HCHAR(X-1,Y,32)
770 X=1
780 CALL HCHAR(X,Y,96)
790 IF J=1 THEN 430 ELSE 320
800 CALL HCHAR(X,Y,96)
810 CALL HCHAR(X-1,Y,32)
820 IF J=1 THEN 430 ELSE 320
830 COL=COL+1
840 IF COL<17 THEN 860
850 COL=1
860 CALL COLOR(9,COL,1)
870 IF J=1 THEN 400 ELSE 320
    
```

Fireworks

The ability to move objects on the screen was a great stride forward, but Home Computer owners demanded more. Users began to look for ways to realize the 99/4's special potential. They devised and refined little tricks to enhance the computer's graphics capabilities. For instance, it is possible to make a character appear invisible by controlling the color of the characters we put on the screen. The character will still be on the screen, but

you won't be able to see it because it will be the same color as the screen. Thus, it's possible to put elaborate—and invisible—graphics on the screen, then change their colors to make either the entire display or just parts of it visible.

The next short program shows how this can be done. *Basic Fireworks* will move a rocket up the screen until it explodes in a dazzling display. The explosion effect is achieved by first printing the patterns on the screen with invisible characters—characters painted the same color as the screen. Once the rocket reaches the explosion point, it is removed from the screen, and the colors of the explosion patterns are changed so they become visible. To improve the effect, the colors change in two stages using two different characters.

Lines 160 to 210 define the graphics patterns of the characters the program will be using. The program uses characters number 80 (P) and number 88 (X) for the explosion. Lines 220 and 230 clear the screen and set its color to black. The PRINT statements in lines 240 to 320 scroll the explosion onto the screen. Although PRINT will cause graphics already on the screen to scroll off, in this case there are no other graphics, so the program can use PRINT instead of the slower CALL HCHAR. Lines 330 to 370 set the different character color groups to their proper colors. Line 380 displays the ground by using the optional fourth variable of HCHAR, which specifies how many times the character is to be repeated. In this example, it starts at row 24, column 1, and repeats 32 times, or all the way across the screen. Line 390 displays the rocket. Lines 400 and 410 are a time delay loop so the rocket doesn't take off immediately. Lines 420 to 480 control the ascent of the rocket. The program logic controls the motion. When the rocket has reached the desired altitude (vertical position 9 on the screen), the loop will terminate and the program will start executing at line 490, whereupon the

Continued on p. 74

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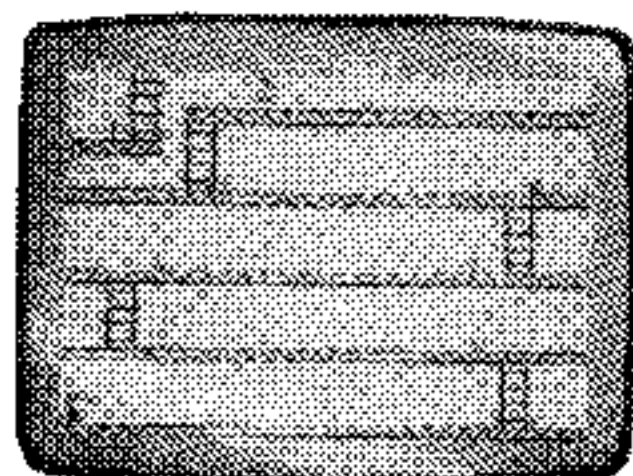
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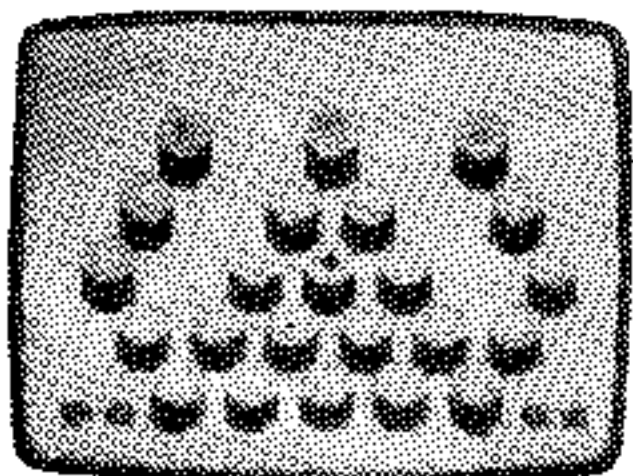
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One of the most useful functions of the personal computer is its ability to collate, sort and alphabetize information. In order for a computer to perform a function, such as sorting by ascending or descending order, it must have a precise, unambiguous procedure to apply to the problem. Such a procedure is called an algorithm.

An algorithm describes a sequence of operations that will, when applied to given information, produce a desired result. In other words, it is simply a recipe or a set of directions. We use algorithms unknowingly every day. Rules for playing a game, road maps, instructions for using your computer, and recipes for cooking are all examples of algorithms.

Directional Algorithms

In order to be useful, an algorithm must be clear, precisely defined and effective. To illustrate, let's look at good and bad algorithms for locating the drugstore. A clear, precise algorithm would read: "Go west for 3 blocks, then turn right at the traffic lights onto Robie Street. Travel on Robie until you come to North Street. Turn left onto North Street, and the drugstore will be immediately on your right, 111 North Street." An unclear algorithm would sound like this: "Go west for a while. Then turn right for several blocks. The drugstore is just around the corner of North Street." To be effective, an algorithm must describe precisely the sequential procedure to follow in order to accomplish a stated task.

The purpose of this article is to consider algorithms (sequences of operations) that will allow the computer to arrange information systematically. Of course, there are all kinds of sorting routines for arranging data (some even in Assembly Language, which are obviously faster). But here we will evaluate 5 routines written in TI BASIC that will provide you with some practical examples for your own programming efforts. They are selection sort, bubble sort, Shell sort, heap sort and quick sort. These algorithms range from very simple to quite complex, and from relatively slow to moderately fast. To look at the listings, one would think that the short, simple routines are faster, but in fact, it is the long, complicated listings that are better and faster algorithms.

Selection Sort

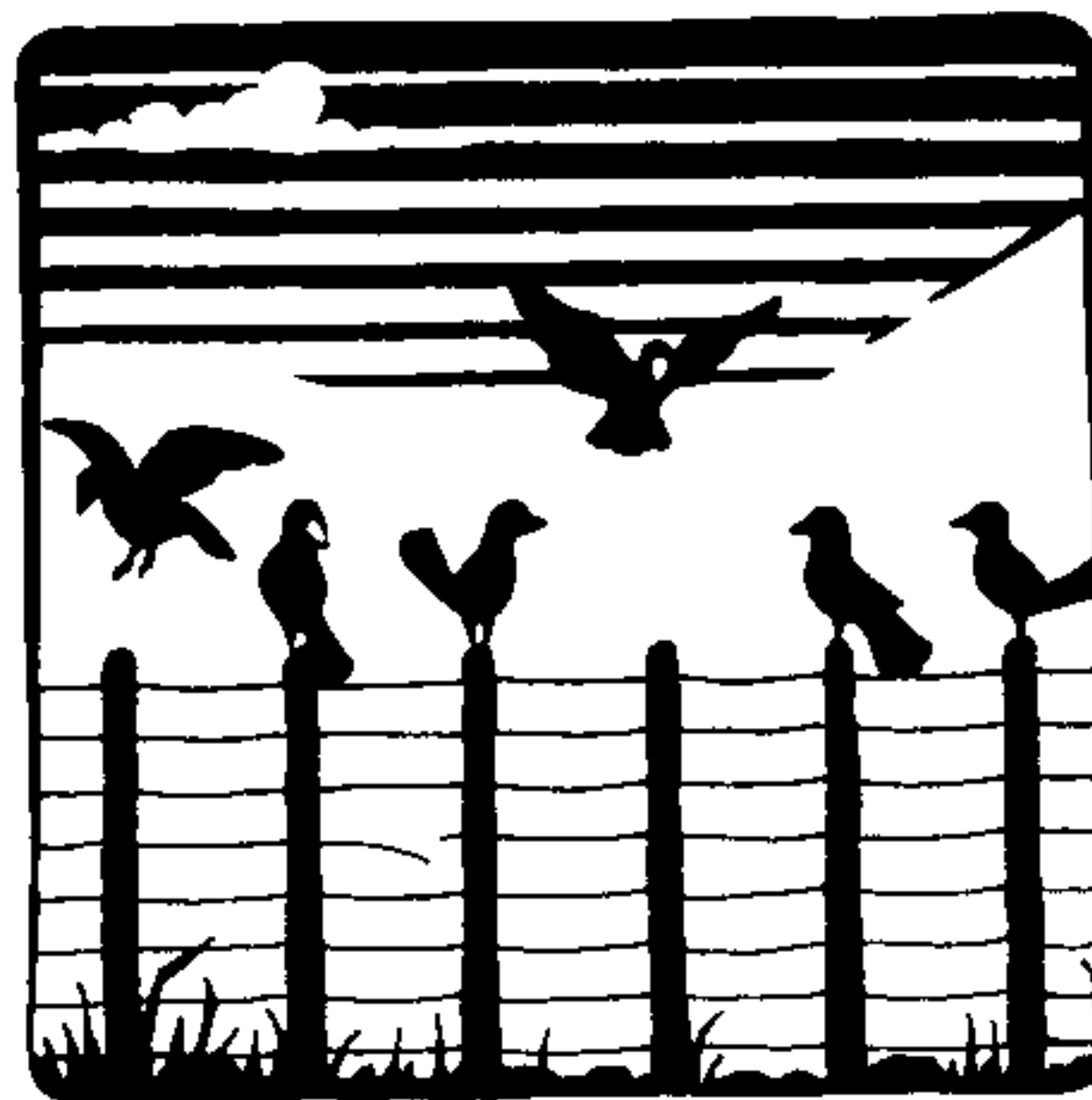
Selection sort is a simple, straightforward routine. It consists of a pair of nested FOR-

NEXT loops—an outer loop FOR I=1 to N-1 and an inner loop FOR J=I+1 to N (see listing which follows). The outer loop takes the first item, and using the inner loop, compares it to every other item in the list, switching each time it finds a lesser value. After completing the inner loop, the outer loop chooses the second item in the list and repeats the sequence until each item has been compared with every other one.

Though it is a simple algorithm, it makes repeated, unnecessary comparisons. This sort always goes through the complete number of passes set in the FOR-NEXT loops, regardless of the state of the list. So an already sorted list will still be put through the entire routine as though it were not sorted.

Selection sort is adequate and even preferable for small lists of items because it is so easy to program. But as you can imagine, this sort takes an unbearably long time with lengthy lists (see Table 1).

As it was the first sort algorithm I learned, I incorporated the selection sort into a membership and mailing list program. After inputting approximately 100 names and addresses, I selected the alphabetize option. Well, I thought I must have spilled molasses on the computer. It seemed to take forever. But even though it is not preferable for long lists, you will notice in Table 1 that the selection sort serves very well for programs with small data entry.



```

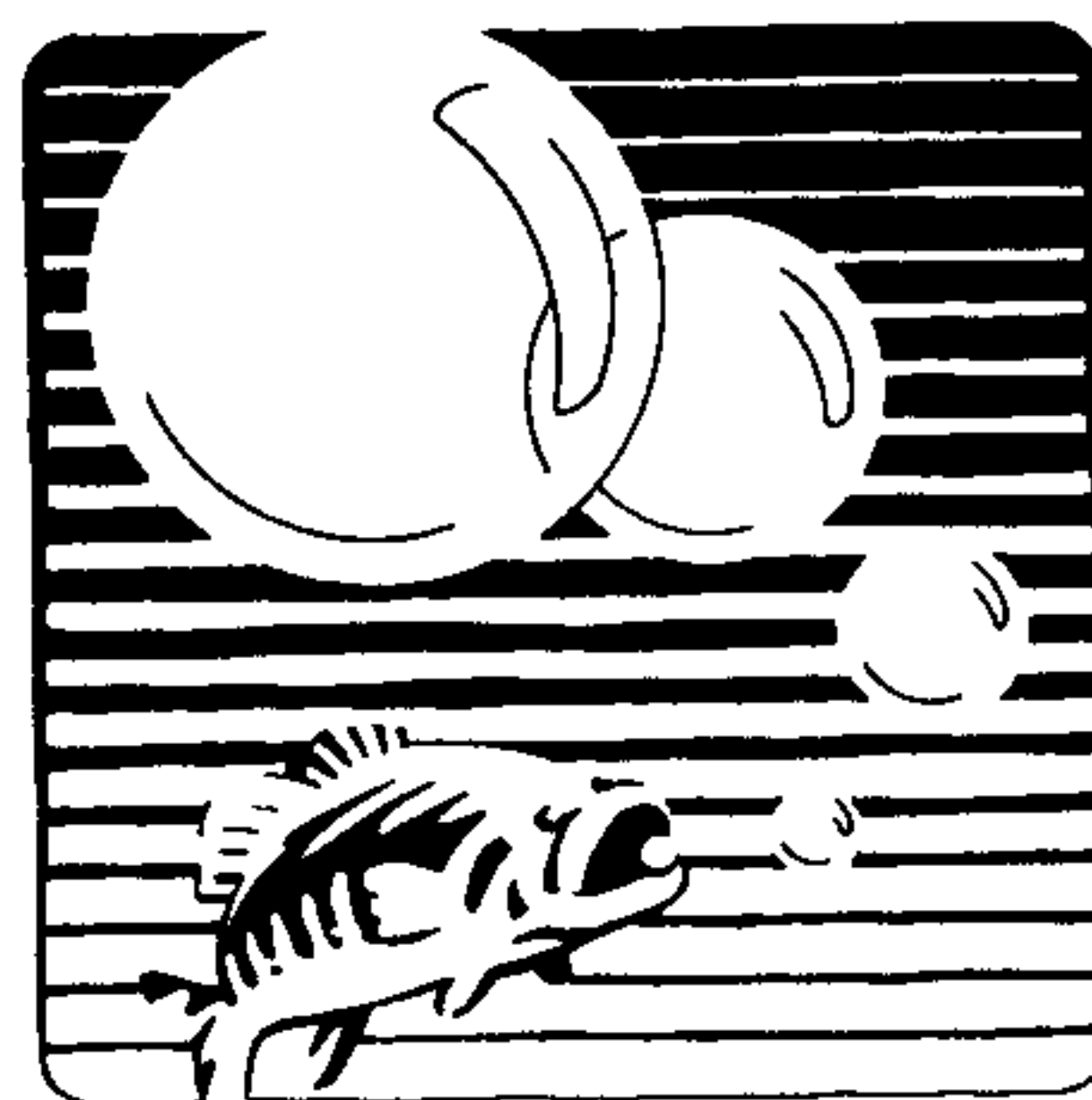
100 REM **SELECTION SORT**
110 DIM A(50)
120 N=50
130 CALL CLEAR
140 REM **CHOOSE AND PRINT RANDOM
    ITEMS**
150 FOR I=1 TO N
160 RANDOMIZE
170 A(I)=INT(RND*100)+1
180 PRINT A(I);

```

```

190 NEXT I
200 PRINT :!!!
210 REM **SORT ROUTINE**
220 FOR I=1 TO N-1
230 FOR J=I+1 TO N
240 IF A(I)<A(J) THEN 280
250 CHANGE=A(I)
260 A(I)=A(J)
270 A(J)=CHANGE
280 NEXT J
290 NEXT I
300 REM **PRINT SORTED ITEMS**
310 FOR I=1 TO N
320 PRINT A(I);
330 NEXT I
340 STOP

```



Bubble Sort

The bubble sort is a very popular routine because it is simple to understand and implement. Unlike the selection sort, it compares only adjacent items, placing them in ascending order. The procedure begins by comparing the first two items in the sequence. If they are out of order, they are exchanged. The procedure continues, comparing the second item with the third, then the third with the fourth, and so on until the sequence is completed. In general, the lower item is moved upward until it is in the correct position. This is called the bubble sort because items which are too low in the sequence will "bubble up" to reach their correct positions.

A flag is used to display whether any items were exchanged during a pass through the sequence (see listing below). At the beginning, FLAG is initialized to 0. If an exchange is made during the sequence, then FLAG is set to 1. This causes the sequence to be repeated until no exchanges are made, at which point the sorting is completed. Bubble sort, therefore, takes only as many passes as it needs. An already sorted list would require one pass to determine that no exchanges were made.

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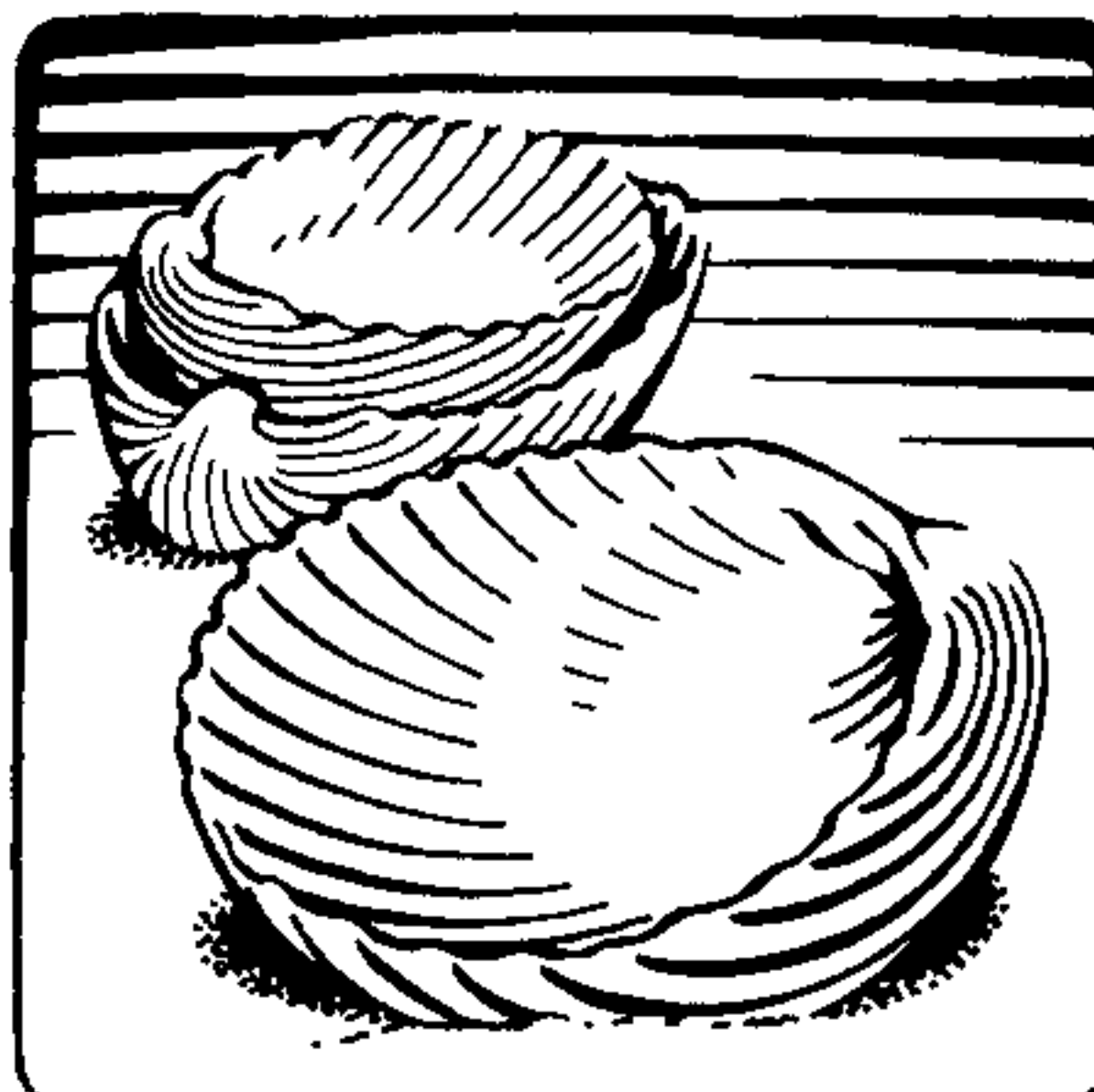
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The bubble and selection sorts are quite simple to understand, but they are slow to use with long lists. The next three sorts to be considered are more complicated algorithms, but they execute at moderately fast speeds.

```
100 REM **PRINT SORTED ITEMS**
110 FOR I=1 TO N
120 PRINT A(I);
130 NEXT I
140 STOP
```

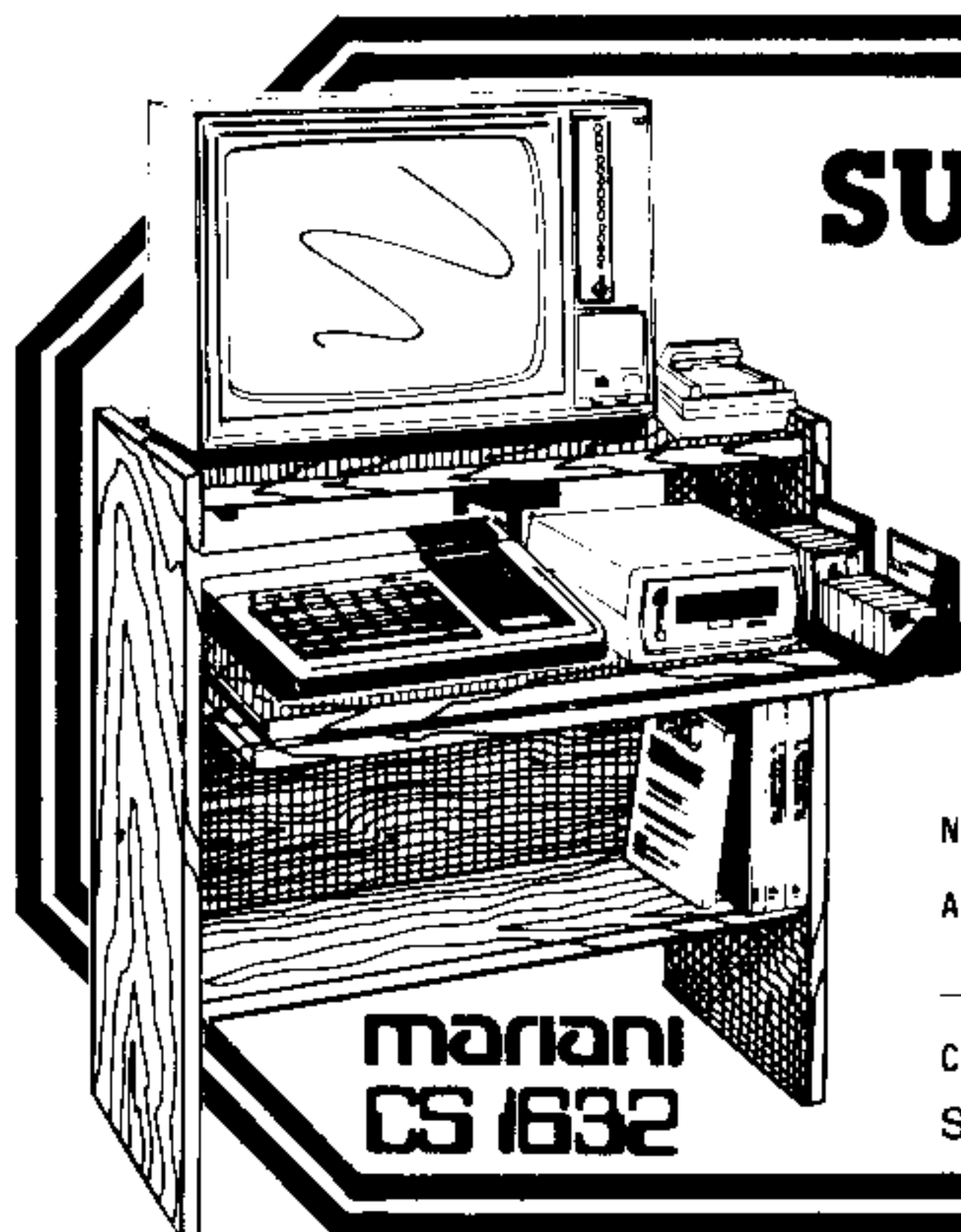


Shell Sort

The Shell sort, named after its originator D.L. Shell, is similar to the bubble sort but consists of a somewhat more complicated algorithm. Initially a "gap" size is determined at approximately 3/4 of N, where N is the number of items contained in the list. Instead of comparing just the adjacent items, as the bubble sort does, the Shell sort compares items separated by the gap size, exchanging them when necessary. After a complete pass, the size of the gap is cut in half and the process continues. The Shell sort is a considerably faster routine than the bubble or selection sorts because it requires fewer comparisons and exchanges.

```
100 REM **SHELL SORT**
110 DIM A(50)
120 N=50
130 CALL CLEAR
140 REM **CHOOSE AND PRINT RANDOM ITEMS**
150 FOR I=1 TO N
```

```
100 REM **BUBBLE SORT**
110 DIM A(50)
120 N=50
130 CALL CLEAR
140 REM **CHOOSE AND PRINT RANDOM ITEMS**
150 FOR I=1 TO N
160 RANDOMIZE
170 A(I)=INT(RND*100)+1
180 PRINT A(I);
190 NEXT I
200 PRINT "==="
210 REM **SORT ROUTINE**
220 FLAG=0
230 FOR I=1 TO N-1
240 IF A(I)>A(I+1) THEN 290
250 CHANGE=A(I)
260 A(I)=A(I+1)
270 A(I+1)=CHANGE
280 FLAG=1
290 NEXT I
300 IF FLAG=1 THEN 220
```

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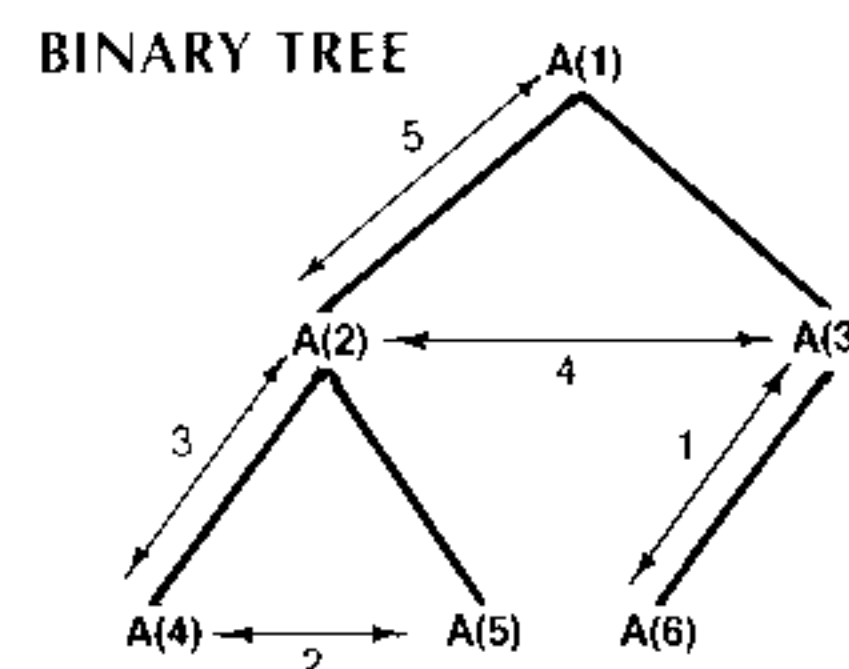
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```

160 RANDOMIZE
170 A(I)=INT(RND*100)+1
180 PRINT A(I);
190 NEXT I
200 PRINT : : :
210 REM **SORT ROUTINE**
220 GAP=N*1.5
230 GAP=INT(GAP/2)
240 IF GAP=0 THEN 610
250 FOR I=1 TO N-GAP
260 J=I
270 K=J+GAP
280 IF A(J)<=A(K) THEN 340
290 CHANGE=A(J)
300 A(J)=A(K)
310 A(K)=CHANGE
320 J=J+GAP
330 IF J>0 THEN 270
340 NEXT I
350 GOTO 230
600 REM **PRINT SORTED ITEMS**
610 FOR I=1 TO N
620 PRINT A(I);
630 NEXT I
640 STOP

```

The following diagram represents the comparisons in one cycle of the heap sort algorithm. The comparisons follow the numbered order, and the interchanges—if necessary—always move the larger value to the array element with the smaller subscript. For example, if A(6) contains 8 and A(3) contains 4, the algorithm puts 8 in A(3) and 4 in A(6). When the largest value reaches A(1), it is exchanged with the value in A(6). Then A(6) is removed from the tree, and the algorithm begins another cycle with A(5).



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Heap Sort

The heap sort is an even more complicated algorithm which involves the use of a *binary tree*. The larger items are worked up a "branch," one by one, until they reach the top. When the largest element has reached the top, it is placed in the last element of the array. That branch is then cut off the tree and the algorithm repeats.

```

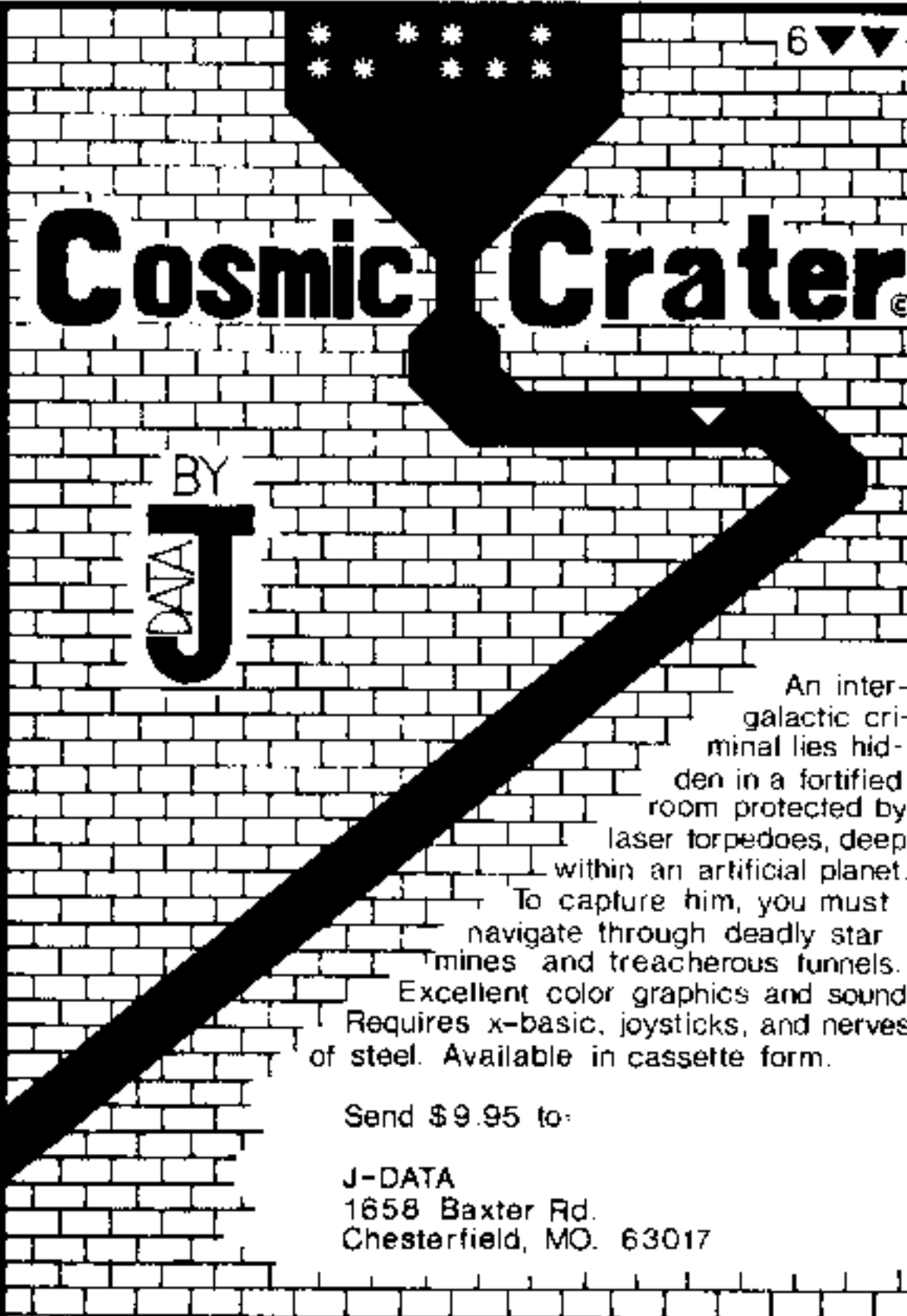
100 REM **HEAP SORT**
110 DIM A(100)
120 N=100
130 CALL CLEAR
140 REM **CHOOSE AND PRINT RANDOM
    ITEMS**
150 FOR I=1 TO N
160 RANDOMIZE
170 A(I)=INT(RND*100)+1
180 PRINT A(I);
190 NEXT I
200 PRINT : : :
210 REM **SORT ROUTINE**
220 K=N
230 L=INT(N/2)+1
240 IF L=1 THEN 280
250 L=L-1
260 S=A(L)
270 GOTO 340
280 S=A(K)
290 A(K)=A(L)
300 K=K-1
310 IF K>=1 THEN 340
320 A(1)=S
330 GOTO 610
340 J=L
350 I=J
360 J=J+J
370 IF J<=K THEN 400
380 A(1)=S
390 GOTO 240
400 IF J>=K THEN 430
410 IF A(J)>=A(J+1) THEN 430
420 J=J+1
430 IF S<A(J) THEN 460

```


6 ▼▼

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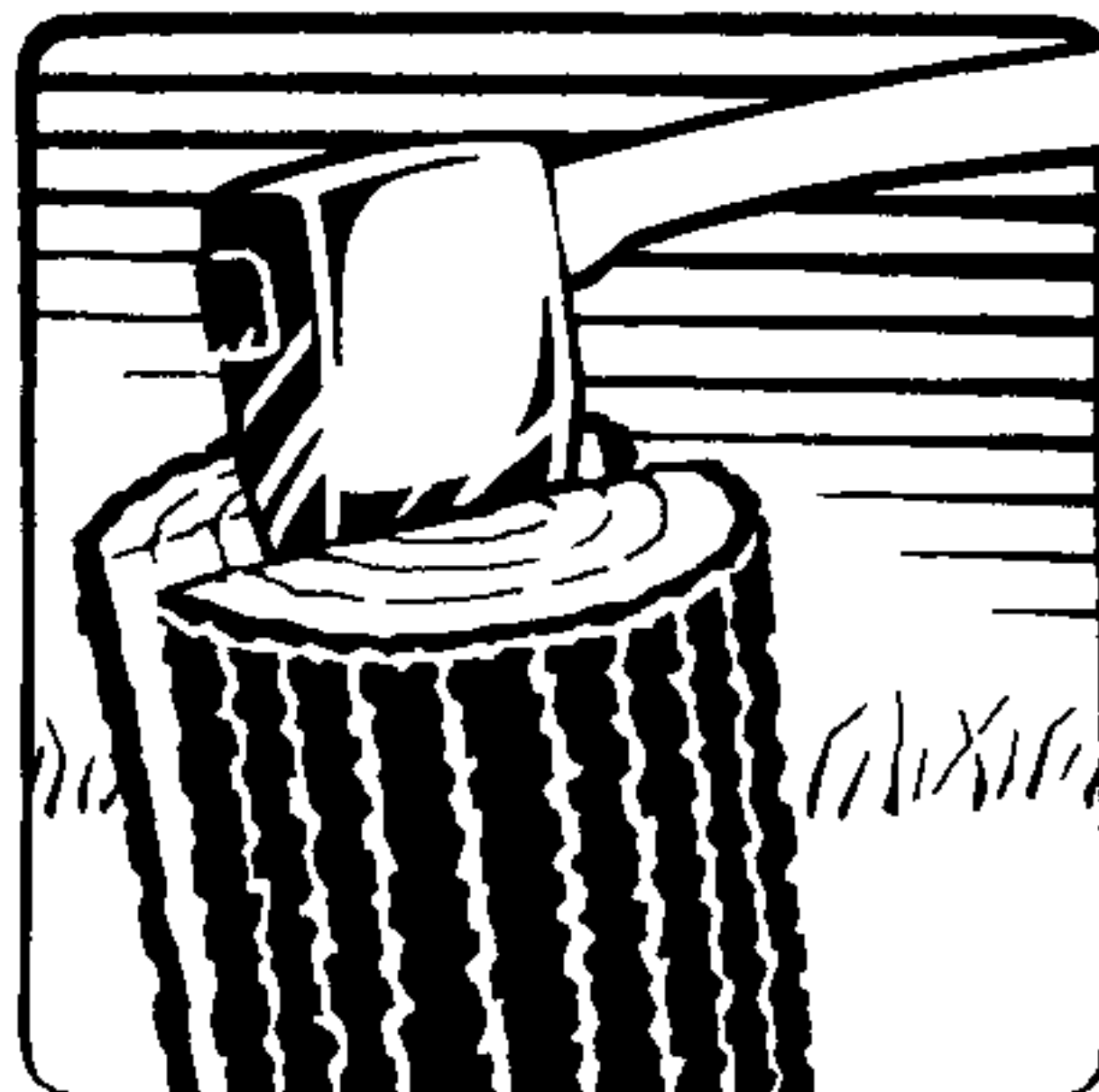
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```

440 A(I)=S
450 GOTO 240
460 A(I)=A(J)
470 GOTO 350
480 REM **PRINT SORTED ITEMS**
490 FOR I=1 TO N
500 PRINT A(I);
510 NEXT I
520 STOP

```



Quick Sort

The quick sort is generally one of the fastest ways (in BASIC) to sort data. It achieves order by first choosing the item on the left end (or bottom) of the list and placing it in its proper place relative to the other items in the list. Then, all the items of lesser value are placed to its left and items of greater value are placed to its right. The list has now been divided into right and left lists. These two lists are repeatedly divided with items being exchanged until the entire array is sorted. Though it is somewhat complicated, the quick sort is a very efficient routine.

```

100 REM **QUICK SORT**
110 DIM A(100)
120 N=100
130 CALL CLEAR
135 REM **CHOOSE AND PRINT RANDOM ITEMS**
140 FOR I=1 TO N
150 RANDOMIZE
160 A(I)=INT(RND*100)+1
170 PRINT A(I);
180 NEXT I
190 PRINT :

```

```

175 REM **SORT ROUTINE**
180 P=1
190 L(P)=1
200 R(P)=N
210 IF P<=0 THEN 610
220 LB=L(P)
230 RB=R(P)
240 P=P-1
250 IF RB=LB THEN 230
260 I=LB
270 J=RB
280 T=A(I)
290 IF J<1 THEN 350
300 IF T>A(J) THEN 350
310 J=J-1
320 GOTO 310
330 IF J>I THEN 380
340 A(I)=T
350 GOTO 500
360 A(I)=A(J)
370 I=I+1
380 IF I>N THEN 440
390 IF A(I)>T THEN 440
400 I=I+1
410 GOTO 400
420 IF J<=I THEN 480
430 A(J)=A(I)
440 J=J-1
450 GOTO 320
460 A(J)=T
470 I=J
480 P=P+1
490 IF I=LB THEN 560
500 L(P)=I+1
510 R(P)=RB
520 RB=I-1
530 GOTO 270
540 L(P)=LB
550 R(P)=I-1
560 LB=I+1
570 GOTO 270
580 REM **PRINT SORTED ITEMS**
590 FOR I=1 TO N
600 PRINT A(I);
610 NEXT I
620 STOP

```

Sort Comparisons

Usually one of the major concerns in determining the efficiency of a sorting algorithm is the speed of the sort. Other factors can also be considered, such as the number of comparisons the sort makes and the number of exchanges executed. But for my purposes, I felt a comparison of the sorting speeds would be of most interest and value to the reader. To test them, I generated repeated lists of random numbers, timing

Continued on p. 76

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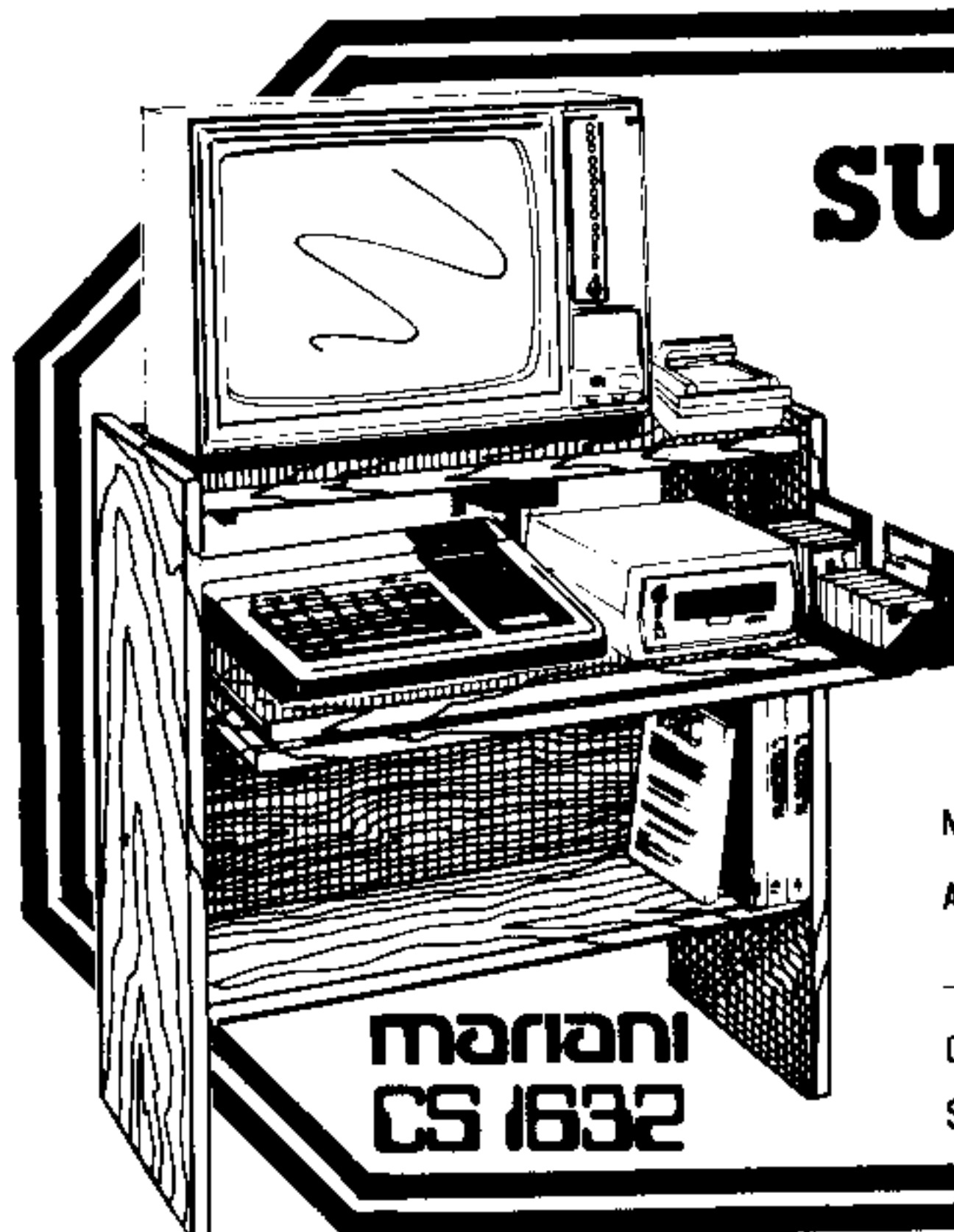
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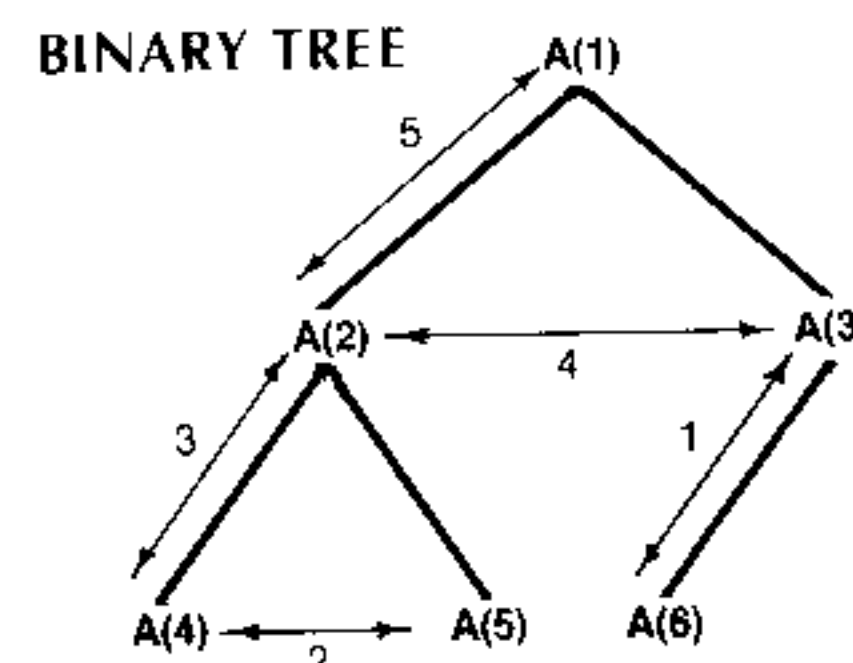
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```
160 RANDOMIZE
170 A(I)=INT(RND*100)+1
180 PRINT A(I);
190 NEXT I
200 PRINT "==="
210 REM **SORT ROUTINE**
220 GAP=N*1.5
230 GAP=INT(GAP/2)
240 IF GAP=0 THEN 610
250 FOR I=1 TO N-GAP
260 J=I
270 K=J+GAP
280 IF A(J)<A(K) THEN 340
290 CHANGE=A(J)
300 A(J)=A(K)
310 A(K)=CHANGE
320 J=J+GAP
330 IF J>N THEN 270
340 NEXT I
350 GOTO 230
360 REM **PRINT SORTED ITEMS**
370 FOR I=1 TO N
380 PRINT A(I);
390 NEXT I
400 STOP
```

The following diagram represents the comparisons in one cycle of the heap sort algorithm. The comparisons follow the numbered order, and the interchanges—always move the larger value to the array element with the smaller subscript. For example, if A(6) contains 8 and A(3) contains 4, the algorithm puts 8 in A(3) and 4 in A(6). When the largest value reaches A(1), it is exchanged with the value in A(6). Then A(6) is removed from the tree, and the algorithm begins another cycle with A(5).



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Heap Sort

The heap sort is an even more complicated algorithm which involves the use of a *binary tree*. The larger items are worked up a "branch," one by one, until they reach the top. When the largest element has reached the top, it is placed in the last element of the array. That branch is then cut off the tree and the algorithm repeats.

```
100 REM **HEAP SORT**
110 DIM A(100)
120 N=100
130 CALL CLEAR
140 REM **CHOOSE AND PRINT RANDOM ITEMS**
150 FOR I=1 TO N
160 RANDOMIZE
170 A(I)=INT(RND*100)+1
180 PRINT A(I);
190 NEXT I
200 PRINT "==="
210 REM **SORT ROUTINE**
220 K=N
230 L=INT(N/2)+1
240 IF L=1 THEN 280
250 L=L-1
260 S=A(L)
270 GOTO 340
280 S=A(K)
290 A(K)=A(L)
300 K=K-1
310 IF K>=1 THEN 340
320 A(L)=S
330 GOTO 240
340 IF J>K THEN 430
350 IF A(J)>A(J+1) THEN 430
360 J=J+1
370 IF B<A(J) THEN 460
```


6▼▼

Cosmic Crater

BY
J

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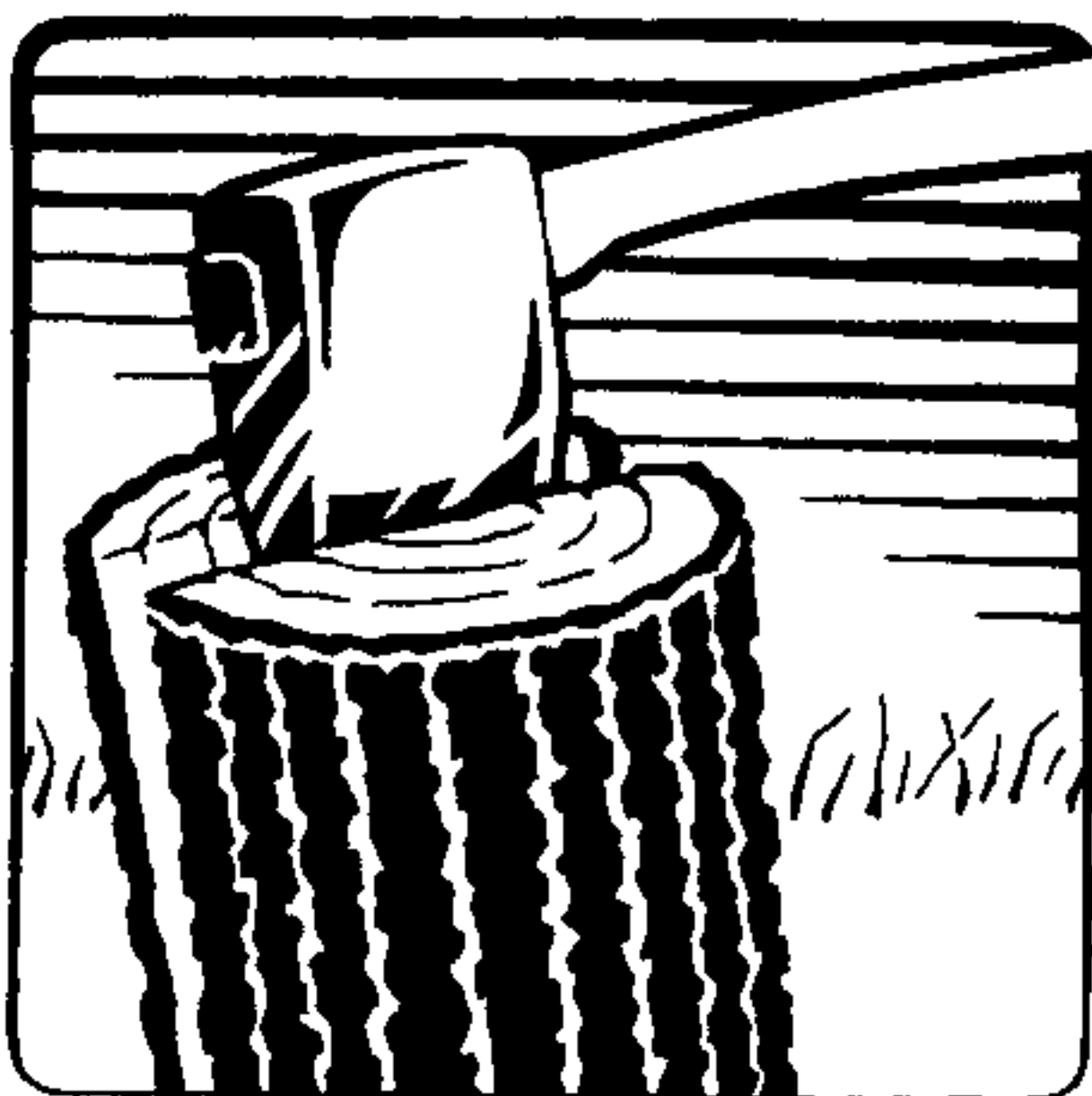
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```

440 A(I)=B
450 GOTO 240
460 A(I)=A(J)
470 GOTO 350
480 REM **PRINT SORTED ITEMS**
490 FOR I=1 TO N
500 PRINT A(I);
510 NEXT I
520 STOP

```



Quick Sort

The quick sort is generally one of the fastest ways (in BASIC) to sort data. It achieves order by first choosing the item on the left end (or bottom) of the list and placing it in its proper place relative to the other items in the list. Then, all the items of lesser value are placed to its left and items of greater value are placed to its right. The list has now been divided into right and left lists. These two lists are repeatedly divided with items being exchanged until the entire array is sorted. Though it is somewhat complicated, the quick sort is a very efficient routine.

```

100 REM **QUICK SORT**
110 DIM A(100)
120 N=100
130 CALL CLEAR
135 REM **CHOOSE AND PRINT RANDOM
    ITEMS**
140 FOR I=1 TO N
150 RANDOMIZE
160 A(I)=INT(RND*100)+1
170 PRINT A(I);
180 NEXT I
190 PRINT " "

```

```

195 REM **SORT ROUTINE**
200 P=1
210 L(P)=1
220 R(P)=N
230 IF P<=R THEN 610
240 LB=L(P)
250 RB=R(P)
260 P=P+1
270 IF RB=LB THEN 230
280 I=LB
290 J=RB
300 T=A(I)
310 IF J<1 THEN 350
320 IF T>A(J) THEN 350
330 J=J-1
340 GOTO 310
350 IF J>1 THEN 380
360 A(I)=T
370 GOTO 500
380 A(I)=A(J)
390 I=I+1
400 IF I>N THEN 440
410 IF A(I)>T THEN 440
420 I=I+1
430 GOTO 400
440 IF J<1 THEN 480
450 A(J)=A(I)
460 J=J-1
470 GOTO 320
480 A(J)=T
490 I=J
500 P=P+1
510 IF I=LB=RB THEN 560
520 L(P)=I+1
530 R(P)=RB
540 RB=I-1
550 GOTO 270
560 L(P)=LB
570 R(P)=I-1
580 LB=I+1
590 GOTO 270
600 REM **PRINT SORTED ITEMS**
610 FOR I=1 TO N
620 PRINT A(I);
630 NEXT I
640 STOP

```

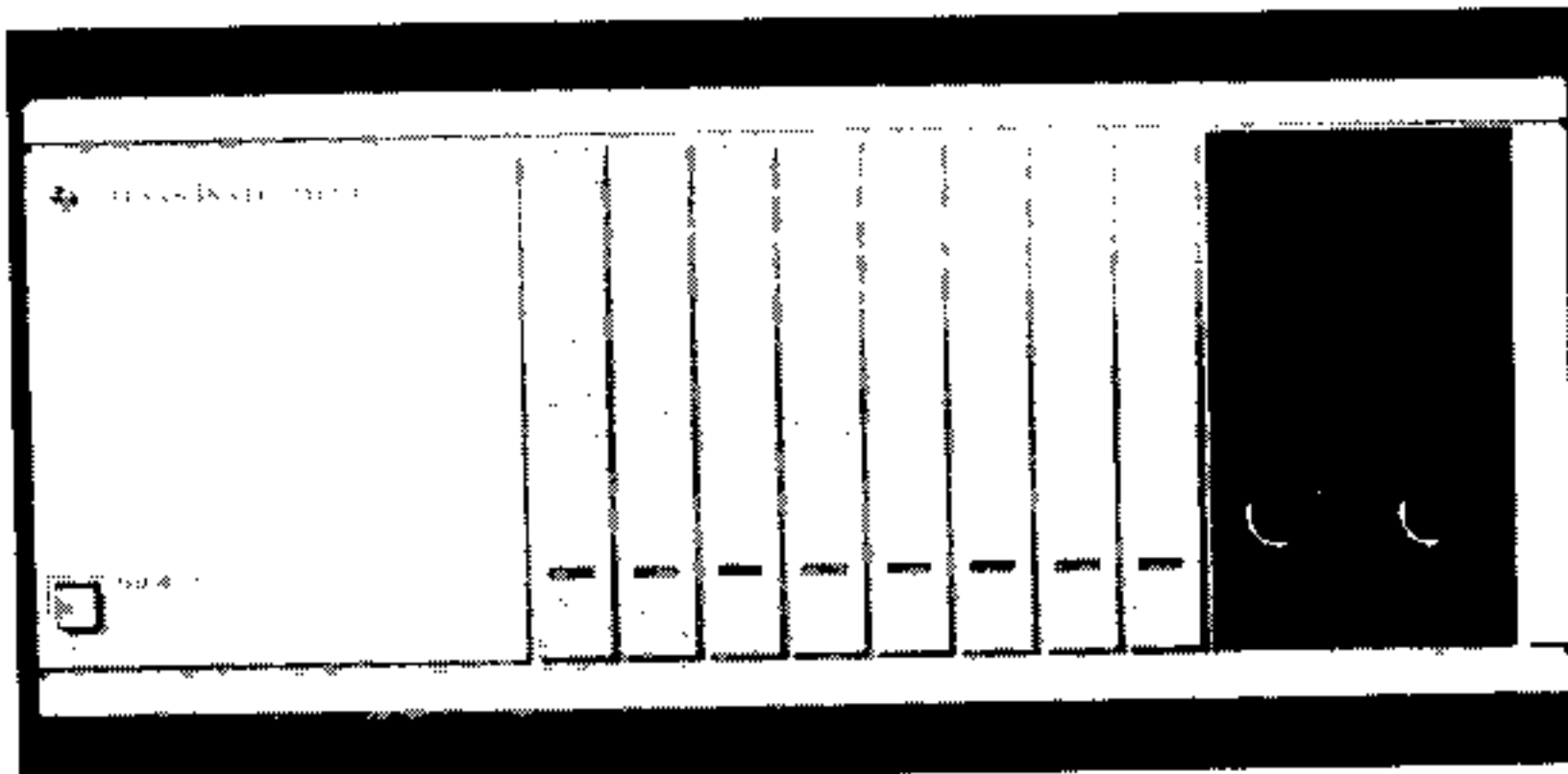
Sort Comparisons

Usually one of the major concerns in determining the efficiency of a sorting algorithm is the speed of the sort. Other factors can also be considered, such as the number of comparisons the sort makes and the number of exchanges executed. But for my purposes, I felt a comparison of the sorting speeds would be of most interest and value to the reader. To test them, I generated repeated lists of random numbers, timing

Continued on p. 76

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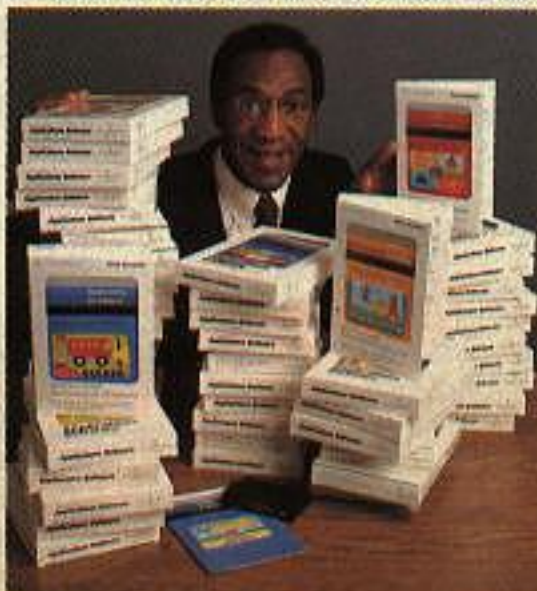
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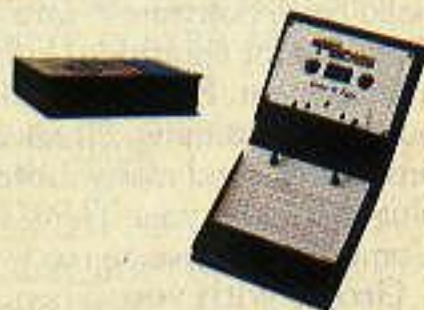
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Stardust Miner

A Review of Pulsar

By Robert B. Hess

2606 NE 185th
Seattle, WA 98155

Name:	Pulsar	EXTENDED BASIC
Author:	Chris A. Root	
Program Type:	Space Mining	
Language:	Extended BASIC	
Distributor:	C. A. Root Associates Suite B109, 33125 15th Ave. S. Federal Way, WA 98003	
Price:	\$14.95, cassette	

System Requirements:
Extended BASIC
Joysticks

	Poor	Fair	Good	Excellent
Game Performance	=====	=====	=====	=====
Engrossment	=====	=====	=====	=====
Documentation	=====	=====	=====	=====

I've been spoiled! I'm used to playing coin-operated arcade games with quick response times and flawless execution. Naturally, I expected this same sort of electronic rush from my home computer. But I was unable to find a game that played with arcade dazzle until I got a copy of *Pulsar* from C. A. Root Associates. *Pulsar* is not a take-off on any video game that I know of, nor does it boast the spellbinding speed of a true arcade game. It does offer fabulous graphics and a fine set of sound effects. It does all this and still leaves you with almost 200 bytes of free program space. *Pulsar* is an excellent example of optimum use of a computer system.

The Story So Far . . .

You are the operator of a fleet of Robot Mining Vessels (RMV's). Your assignment is to gather up the ore from the solar systems that have been charted for you. There is, of course, one little catch. Since you are so good at your job, your crew has been assigned every solar system that contains a star which is about to go supernova. (It's a dirty job, but somebody has got to do it.) Within your assigned systems you will face dangers and diversions of various sorts. And what is your reward for braving these numerous perils? Why, you will be one of the chosen few who get to go out and do it all again!

Playing the Game

As you start the game, you are given a first little taste of the extra work that went

Computer Gaming

Computer Gaming is a section for all game lovers—players, designers, and programmers of microcomputer games. Regular features include product reviews, letters to the editor, player strategy, a question and answer forum, a Hall of Fame for high scorers, tutorial articles on game design and programming, plus interviews with professionals in the world of computer gaming.

All submissions for *Pros on Programming* are governed by the same conditions and payment rate as manuscripts sent to other departments of 99'er Home Computer Magazine. Materials submitted for the features shown below are treated the same for Copyright purposes as *Letters to the Editor* in 99'er Home Computer Magazine (as explained in the Masthead); if chosen for publication, the material (except for 99'er Hall of Fame) will earn for its author a free computer game (either TI or third-party) and/or a one-year subscription to this magazine.

99'er Hall of Fame candidates with high scores in TI, third-party, or Computer Gaming games must completely describe the conditions under which their scores were achieved (i.e., skill level, keyboard or joystick use, screen number, partner participation, appearance of screen, etc.) Candidates may not be directly related to or affiliated with the programmer of the game or the publishing firm. No compensation will be provided to new inductees whose names are chosen to be immortalized—Fame is its own reward.

Game Review Criteria

Game Performance measures how well the game responds to the player's commands, rates the quality and realism of the graphics and animation, and examines how well the sound effects, music or speech are integrated into the game. It also determines whether the game delivers what is promised in its advertisements.

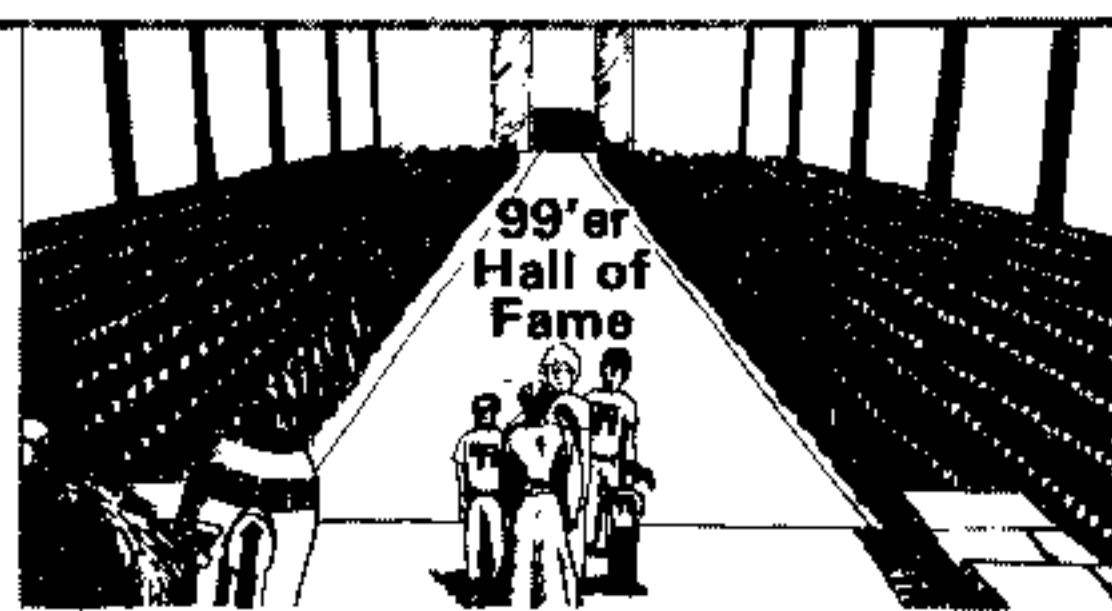
Engrossment focuses on that intangible quality that holds the player on the edge of his seat while the hours tick by unnoticed. The game's staying power is also assessed.

Documentation rates the printed matter that comes with the game. It notes whether the instructions are clear, comprehensive and easy to use, whether the machine configuration requirements are spelled out, and looks for such information as how to load the program, use the keyboard, and restart the game.

Adventure Registry



Strategy Corner



into *Pulsar's* special effects. Six sprites are defined to spell out "Pulsar." They are expanded across the screen, then rotated into position while an eerie refrain plays in the background. You are then asked to be patient while you are transported to a distant part of the galaxy (as in a state of suspended animation).

Once all of the necessary parameters have been initialized, the display clears and you see what could be a viewscreen on board the mother ship. In the center of the screen is a pulsating star. Scattered randomly around the star are fragments of Terrellium ore, a mineral which has become so important to your planet's sagging economy that you and your crack crew must risk life and limb to mine it.

To collect the ore, you simply position your RMV over it via the joysticks (there is no keyboard control). By pressing the fire button you load the ore into your cargo hold. At first, your only concern is to avoid the Gamma Rays that are slowly but constantly emitted from the Pulsar. When a Gamma Ray passes through your ship, it contaminates the ore, altering its composition, which unfortunately also reduces its final value. In the later waves, the Gamma Rays become so intense that they start a chain reaction in the fuel cells of your RMV, causing the explosive demise of your vessel. And from the second wave on, you are faced with another problem—a wandering comet. The comet vertically tracks your ship while maintaining a constant horizontal motion. Impact with the comet will, of course, bring

about the destruction of your RMV.

The Empire Strikes . . .

By now, you are beginning to feel that someone in the dispatch office doesn't like you. Wait, there's more . . . from wave three on, all the systems to which you have been assigned are located within the range of the Senerec Empire. The Senerecs chose not to develop a mining fleet, but instead built a fleet of pirate ships that patrols their nearby systems. When they locate a mining ship, they use a special tractor beam to rob the ship of its precious ore. If there is no ore for the beam to pick up, it sets off a counter-vibration in your ship that rips it apart.

If you can survive all of these dangers as well as the navigational difficulties created by occasional sunspots, all that remains is to dock successfully with the mother ship. When the mother ship senses that the star is about to go super-nova, it comes into the top of your screen and slowly tracks across the top of the display. When it is directly above your RMV, you signal that you are ready to be picked up by pressing the fire button. The mother ship sends down a tractor beam that pulls you into the safety of its hold. There you are awarded extra points for the value of the ore that is left in your cargo. But don't get too comfortable—you are soon off to your next destination. If you fail to dock before the timer runs out, the mother ship has no choice but to hyper off to the next system, leaving your hapless RMV to

Continued on p. 82



A Review By Judy Sanoian

99'er HCM Staff

Name: Mean Streets
Authors: John D. Gardner and John C. Williams
Program Type: Cops and robbers
Language: Extended BASIC
Distributor: Alpha Software
 P. O. Box 463
 West Seneca, NY 14224
Price: \$17.95, cassette or disk

System Requirements:
 Extended BASIC Cartridge
 Cassette Recorder

	Poor	Fair	Good	Excellent
Performance	[Bar chart showing Good]			
Engrossment	[Bar chart showing Good]			
Documentation	[Bar chart showing Fair]			

Dark, dead-end streets, tall skyscrapers, cops on the prowl—a stark view of the naked city confronts us in *Mean Streets*, a SWAT team shoot'em up from Alpha Software. The full moon in the corner of the screen hints that the loonies will be out tonight and indeed they are—not the street punks and underworld characters of Scorsese's *Mean Streets*, but a quasi-political band of terrorists who are out to sack the Last National Bank.

Here's the scam: The Seylenese Liberation Attack Group (SLAG) have robbed the bank and are attempting to escape when your SWAT team is called in. All three escape routes are sealed off, so you (the cop) must face them in a kill-or-be-killed shootout. For tactical reasons, the SWAT members are deployed singly to fight the urban blighters. When the robbers are hit, they are reduced to horizontal lines (never has the term "rubbed out" seemed so apt), and the cops get 100 points. But don't think you can relax once you transform your enemy into a SLAG heap; these guys are fanatical cop haters and may keep shooting until they die.

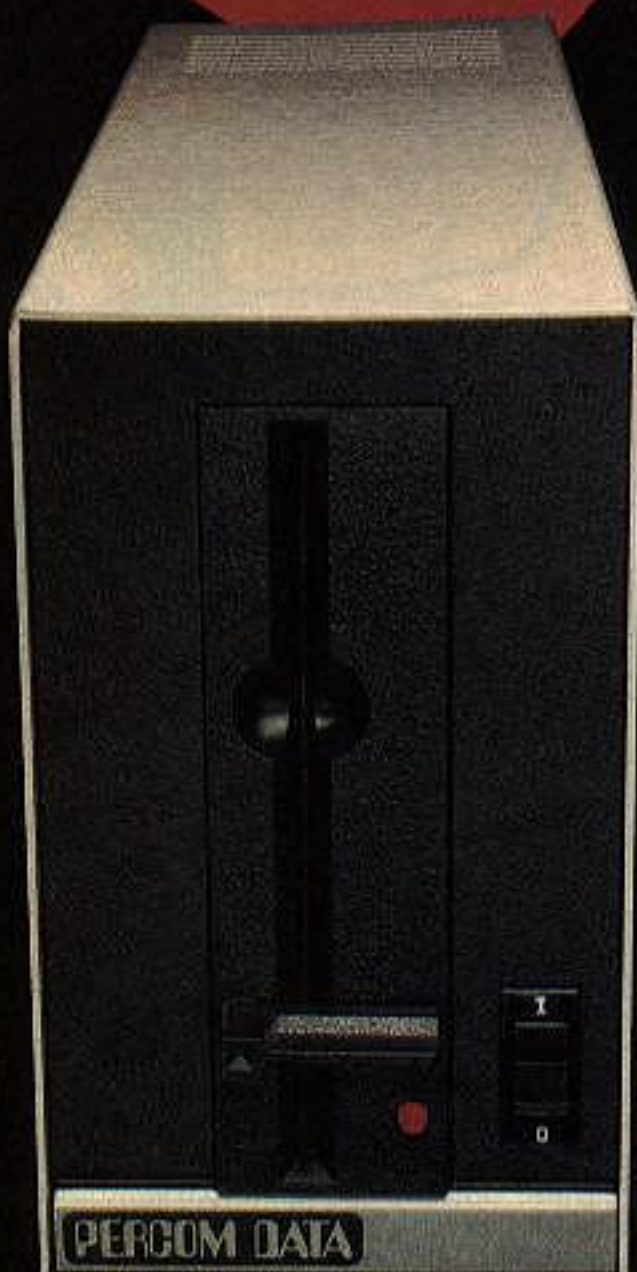
Graphic Excellence

The striking graphics in *Mean Streets* offer a refreshing dose of realism. Fantasy-scapes seem to predominate in today's game market, so it's nice to see a real earth scene for a change. The dark night, full moon and tall, forbidding buildings evoke a mood of danger, crime, and evil forces lurking in dark alleys. There is also a very effective use of perspective to give the buildings a three-dimensional feel, instead of the flat look that characterizes so many computer game scenes.

Unfortunately, the animation in *Mean Streets* does not measure up to the excellent graphics. The cops cannot move up or down, so they end up sliding back and forth on the main drag like trains on a track. The gunfighting tactics are also lacking in realism. It is not possible to fire

Continued on p. 82

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GAMEWARE

BUFFET

ESTABLISHED FOR THE 99/4A



Treasure Island

By Garry John Smith

6841 SE Romona St.
Portland, OR 97206

Yo ho ho and a bottle of rum—or several bottles of rum, strings of pearls and even gold doubloons. That's what you're after when you play *Treasure Island*. It all starts out very quietly with a tranquil voyage across the sea, but once you reach the island and uncover the treasure map, there is a sudden change of pace. A few paces south, a few paces east—Ah-ha! There's the treasure, and boy, are you lucky! You get 16 bottles of rum, 4 strands of pearls and 12 gold doubloons! Oh no—a pirate has discovered you counting your loot. Now what? Can you outrun him and find more treasure, or will you try to escape with the wealth you have? Maybe you could strike a bargain with the brigand. Whatever you do, watch out—he's faster on that peg leg than he looks, and his sword is sharp.

Two Heads Are Better Than One

Treasure Island is an Extended BASIC game that tests your wits and ability to follow directions. Designed for either one or two players, the game is played entirely with the keyboard; you use the arrow keys to move toward the treasure and

away from the pirate. Once you arrive on the island, press [R] to reveal the direction and number of paces to the treasure. When we played, it seemed that the sooner we found the treasure, the more valuable it was. The distance subprogram measures the exact number of paces, but the direction can be expressed only approximately.

Occasionally there is a snake on the treasure, but Revealing the paces a few times will eliminate it. On the beginner's level there is no snake, and it takes longer for the pirate to show up. On the expert level the pirate comes up much sooner.

Be Rich But Beware

After you find the treasure, press [W] to display your bounty on the wealth screen. The pirate will also appear, and you may either bargain with him to buy your freedom or try to escape his greedy wrath. The pirate will take either your rum, pearls, or gold up to a certain point. If he will no longer bargain with you, you must run back to your ship (if you can) or risk being captured by the pirate while you try to look for more treasure chests. You always have the option of leaving the island at any time during the game.

The score screen compares Player 1's accumulation of wealth to Player 2's. If one player is captured, the other wins by default and no score is displayed.

If you are clever, you can amass quite a fortune. So avast, me hearties—we set sail for *Treasure Island* as soon as you can key it in!

EXTENDED BASIC

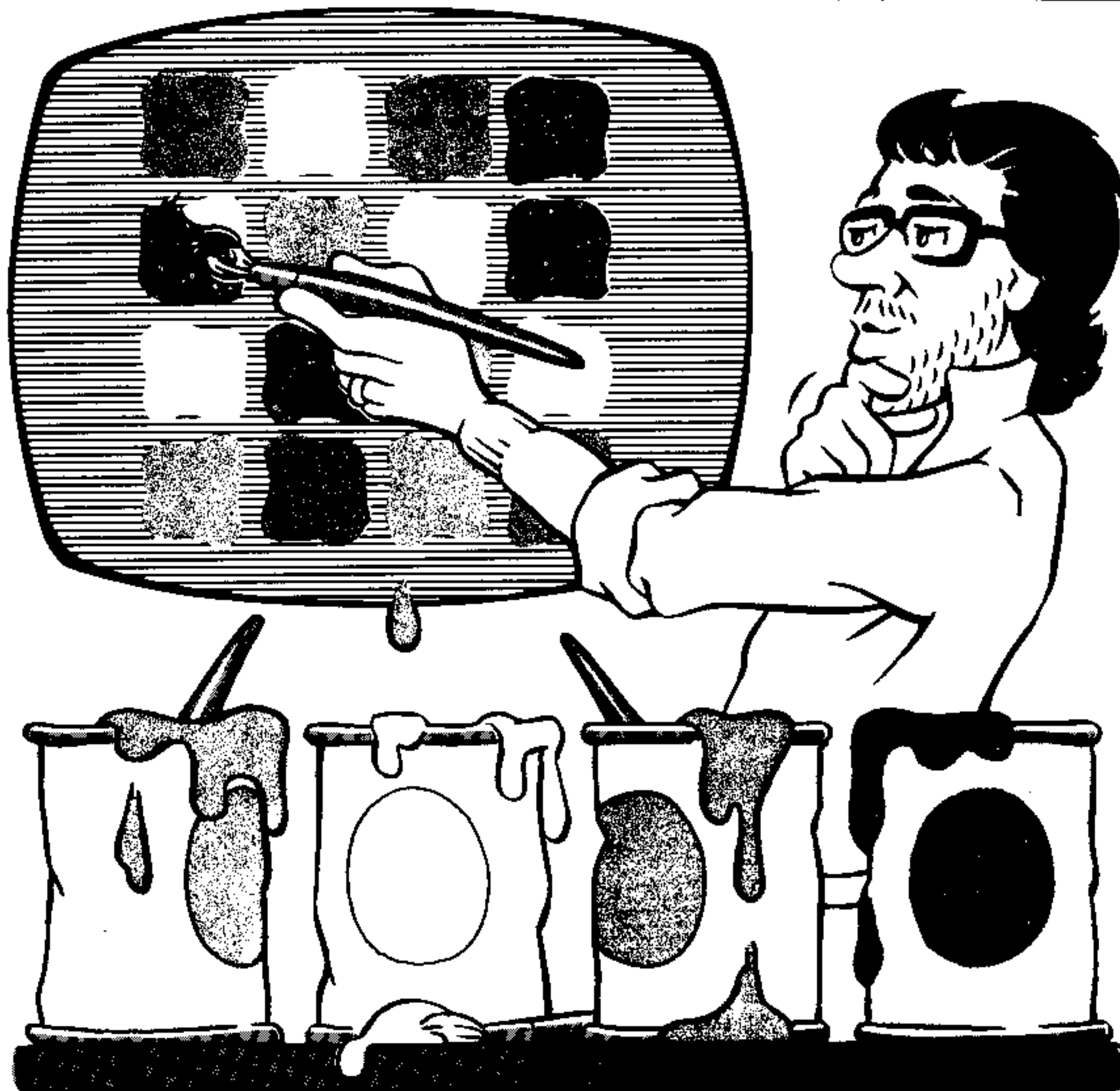
Treasure Island Explanation of the Program

Lines Nos.	
100-170	Program header.
180-370	Instructions and title screen.
380-410	Defines characters
420-480	Moves sprite and plays music for voyage.
490-560	Defines island.
570-770	Main game loop.
780-820	Locates treasure(s) at random
830-940	Sets treasure distances and snake appearances.
950-1060	Treasure found routines.
1070-1380	Bargaining routines.
1390-1520	Defines island.
1530-1560	Defines and moves pirate.
1570-1680	Displays winning score routines.
1690-1720	Replay or End option.
1730-1760	Routines on losing

```

100 REM *****
110 REM * TREASURE ISLAND *
120 REM *
130 REM * BY G.J. SMITH *
140 REM *****
150 REM
160 REM 99'ER VERSION 2.9.1XB
170 REM
180 CALL CLEAR :: DISPLAY AT(12,6)
190 : "INSTRUCTIONS?(Y/N) N"
200 ACCEPT AT(12,25) VALIDATE("YN")
210 SIZE(-1)BEEP:IN$
220 IF IN$="N" THEN 340
230 PRINT "FIND ALL THE TREASURE Y
DU": "CAN, BE CAREFUL TO RETREA
T": "BACK TO THE BOAT & END THE
"
```

Continued on p. 49



By Phyllis Judge

P. O. Box 888563
Dunwoody, GA 30338

Yellow, Red, Blue, Green if you think that looks keen and mellow, wait until you make them Green, Blue, Red, and Yellow!

That's the object of this game, to turn the rows upside down in the fewest possible moves. *Switch-A-Row* presents you with a colorful 4x4 display of 16 squares. One blank square winks conspiratorially at you from the top yellow row while the other 15 squares stay put, awaiting your strategic commands. By repeatedly switching an adjacent colored square with the blank square, you can rearrange all the squares. Finally, when all the colors of the rows have been reversed, you have won! You win every time in this game. The question is, can you win in fewer moves each time?

To move a square, enter its coordinates by row letter (A, B, C or D) and column number (1, 2, 3 or 4). If the move is valid, that colored square will switch with the blank one. The computer keeps track of your total number of moves and displays the count as the game progresses.

The Long and Short of It

Now that you've got the basics, you

are ready to get started keying in *Switch-A-Row*. If you think you can do without screen titles and instructions for now, you can delete lines 1290-1430 and lines 1530-2630. The game will remain intact, and you can key in the deleted lines later, after you've done some serious playing!

Long version or short, young and old alike will enjoy this game. Adults can improve their strategy skills while preschoolers can use *Switch-A-Row* to learn their colors. So cozy up to your console and start switching those squares to see how many moves it will take you to complete *Switch-A-Row*.

BASIC

Switch-A-Row Explanation of the Program

Line Nos.	
100-170	Program header.
180-330	Initialize characters and colors.
340-410	Opening sounds.
420-560	Opening masthead.
570-650	Data
660-1760	Instructions.
1770-2120	Play screen.
2130-2620	Play game.
2800-2910	Invalid entry routine.
2920-3050	Quit or play again routine.

```

100 REM *****
110 REM ** SWITCH-A-ROW **
120 REM ** BY **
130 REM **PHYLLIS JUDGE**
140 REM *****
150 REM
160 REM 99'ER VERSION 2.9.1
170 REM
180 CALL CLEAR
190 CALL SCREEN(8)
200 CALL CHAR(112,"0000")
210 CALL CHAR(113,"FFFFFFFFFFFFFFF")
220 CALL CHAR(120,"0000")
230 CALL CHAR(121,"FFFFFFFFFFFFFFF")
240 CALL CHAR(128,"0000")
250 CALL CHAR(129,"FFFFFFFFFFFFFFF")
260 CALL CHAR(136,"0103070F1F3F7FF")
270 CALL CHAR(137,"B0C0E0F0F8FCFEF")
280 CALL CHAR(138,"FFFEFCFBF0E0C0B")
290 CALL CHAR(139,"FF7F3F1F0F07030")
300 CALL COLOR(11,7,12)
310 CALL COLOR(12,3,5)
320 CALL COLOR(13,8,2)
330 CALL COLOR(14,7,8)
340 CALL SOUND(150,587,3)
350 CALL SOUND(150,523,3)
360 CALL SOUND(150,587,3)
370 CALL SOUND(450,622,2)
380 CALL SOUND(150,587,3)
390 CALL SOUND(150,523,3)
400 CALL SOUND(150,587,3)
410 CALL SOUND(450,659,1)
420 GOSUB 660
430 FOR DELAY=1 TO 50
440 NEXT DELAY
450 RESTORE 560
460 FOR I=1 TO 2
470 READ X,Y,D#
480 GOSUB 2490
490 NEXT I
500 CALL KEY(0,K,ST)
510 IF ST=0 THEN 500
520 IF K=78 THEN 1770
530 IF K<>89 THEN 500
540 CALL CLEAR
550 GOTO 1530
560 DATA 22,8,NEED INSTRUCTIONS?,2
570 DATA 1,9,"SWITCH-A-ROW"
580 DATA 113,120,121
590 DATA 21,12,MOVES:
600 DATA 23,4,"*****INPUT Q TO QUI
T*****"
610 DATA 23,4," CONGRATULATIONS! W
INNER!!"
620 DATA 23,4," TYPE 1 TO PLAY, Q
TO QUIT"
630 DATA 20,26,NOT,21,25,VALID
640 DATA 6,3,HOPE YOU ENJOYED THE
GAME,12,5,WANT TO TRY AGAIN?,1
650 DATA 121,120,113
660 CALL HCHAR(4,7,137)
670 CALL HCHAR(4,6,113)
680 CALL HCHAR(4,5,136)
690 CALL HCHAR(5,5,113)
700 CALL HCHAR(6,5,139)
710 CALL HCHAR(6,6,113)
720 CALL HCHAR(6,7,137)
730 CALL HCHAR(7,7,113)
740 CALL HCHAR(8,7,138)
750 CALL HCHAR(8,6,113)
760 CALL HCHAR(8,5,139)
770 CALL VCHAR(4,9,113,4)
780 CALL HCHAR(8,9,139)
790 CALL HCHAR(8,10,113)
800 CALL HCHAR(7,10,136)
810 CALL HCHAR(7,11,113)
820 CALL HCHAR(7,12,137)
830 CALL HCHAR(8,12,113)
840 CALL HCHAR(8,13,138)
850 CALL VCHAR(4,13,113,4)

```

Continued on p. 46

If you're on a small budget...

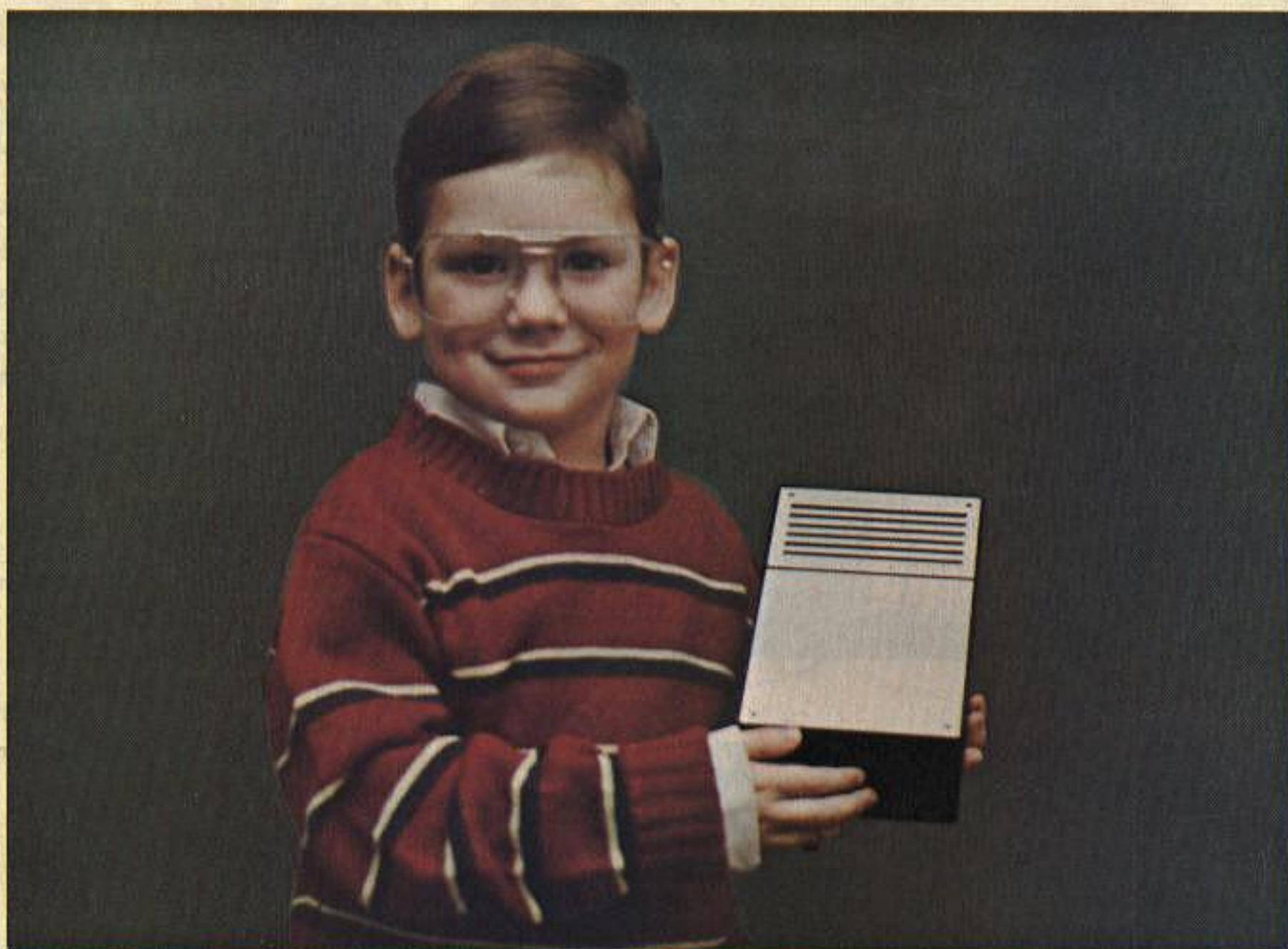


Photo: Peter Rossi

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"By George, You've Got It!"

By Ron Binkowski

428 Adams
Dolton, IL 60419

Welcome to the club! You are now a member of that popular society of forward-looking computer enthusiasts who sent in their six box tops and received TI's free Speech Synthesizer. Many of you are now asking: What can the Speech Synthesizer do, other than spice up some of my educational Command Cartridges? Well, you've come to the right place. With *Speller* you can use your new peripheral to create a customized word list to help you improve spelling, learn vocabulary words—even master a foreign language.

Small but Mighty

How does one small program do so much? *Speller* is designed to allow you to add to the Speech Synthesizer's resident vocabulary with a phonetic "re-say" feature. After you type in a word to your list, the program asks if it has pronounced the word correctly. If you answer "no," it asks you to enter it again phonetically. You actually teach the computer how to talk! You can use this system to prepare a spelling test of up to 50 words and 50 pronunciations. The information is processed on line 340 of the program. Line 340 also provides arrays for 3 variations of statements to indicate the spelling words and 3 responses to misspelled words. There is space to indicate both correctly spelled words and how the words are spelled the first time on the test. There is even room for 50 sentences!

Once you've ENTERed all of your words, *Speller* will go to work to help you learn them (if you have tutored it well in the ways of pronouncing your words). It will prepare a test for you with each word pronounced once, given in a sentence, and pronounced again—just as in a spelling bee!

Test and Results

Before you take the test, you must tell the computer how many tries to give you before it considers the word misspelled. Individualizing the program in this way will allow spellers of varying abilities to have

success with it. Adjusting the number of trials rather than the list builds the speller's confidence—a poor speller need not start out with "baby" words but will instead get more chances to spell the words correctly. After you take the test, a list of problem words is printed along with the number of tries it took to spell them correctly. The screen also shows the first incorrect spelling. By looking over this display, you can identify areas in which you need additional help.

Because of *Speller's* phonetic feature, the program may also be used to help you learn foreign languages. All you need to add is the definition of an input standard to tell the student how to place the accent marks—whether they are to precede or follow the letter they are to stress, e.g., L' > EL < EVE will result in l'élève.

Speller Explanation of the Program

Line Nos.	
100-190	Program header.
200-330	Instructions.
340	Dimensions arrays for variables.
350-380	Puts the 3 variations in the ASKS array.
390-420	Puts the 3 variations in the WRONGS array.
430-550	Requests number of words to be used and number of trials for each word.
570	Opens speech.
580	Sets levels.
590-820	Loop to input a word, check the pronunciation, and speak a sentence if requested.
830-1160	Loop for the computer to say/speak words and request spellings.
990-1140	Routines for an incorrect spelling.
1170-1260	Prints the words, number of tries used, and the last spelling for each incorrect word.
1270	Done.

As an added incentive, you can key in your favorite short BASIC game at the end of this program and allow one play if the student spells a certain percentage of words correctly. Before you key in a game listing, be sure to adjust line numbers accordingly. It might also be a good idea to add 10,000 to all line number references in the game.

```

100 REM *****
101 REM *      SPELLER      *
102 REM * BY RON BINKOWSKI *
103 REM *****
104 REM
105 REM 99'er VERSION 2.9.1
106 REM
107 CALL CLEAR
108 REM
109 REM
110 PRINT : : :
111 PRINT "DO NOT ENTER COMMAS IN
112 THE"
113 PRINT "SENTENCES. JUST PRESS E
114 NTER"
115 PRINT "IF NO SENTENCE DESIRED.
116 "
117 PRINT
118 PRINT "YOU CAN USE THIS FOR FO
119 REIGN"
120 PRINT "LANGUAGES TOO!"
121 PRINT : : :
122 PRINT "WHEN SPELLING PRESS ENT
123 ER TO"
124 PRINT "REPEAT A WORD."
125 PRINT : :
126 PRINT "PRESS ANY KEY TO CONTIN
127 UE"
128 CALL KEY(0,KEY,STATUS)
129 IF STATUS=0 THEN 320
130 RANDOMIZE
131 DIM TOSPELL$(50),SAID$(50),ASK
132 $(3),WRONG$(3),RIGHT$(50),SPELL
133 ED$(50),SENTENCE$(50)
134 DATA "SPELL","NOW SPELL","N
135 EXT SPELL"
136 FOR X=1 TO 3
137 READ ASK$(X)
138 NEXT X
139 DATA "THAT IS ^WRONG","^WRONG"
140 ",^SORRY. TRY AGAIN"
141 FOR X=1 TO 3
142 READ WRONG$(X)
143 NEXT X
144 CALL CLEAR
145 PRINT "YOU MAY USE UP TO 50 WO
146 RDS"
147 INPUT "HOW MANY WORDS: ":HOWMA
148 NY
149 IF HOWMANY>0 THEN 500
150 CALL SOUND(-111,111,1)

```

Continued on p. 30

Psychometric

An eight part mental health inventory
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RELATIONSHIPS

Offered only as an aid to individual self-awareness; this program does not provide any psychiatric treatment, is not a substitute for professional psychological counseling, nor is it intended as such.

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REVIEWED IN JAN. 99'er

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```

400 GOTO 440
500 IF HOWMANY>50 THEN 480
510 CALL CLEAR
520 PRINT "HOW MANY TRIES AT EACH
    WORD?"
530 INPUT "      ":TRIES
540 IF TRIES>0 THEN 570
550 CALL SOUND(-111,111,1)
560 GOTO 510
570 OPEN #1:"SPEECH",OUTPUT
580 PRINT #1:"//38 120"
590 FOR X=1 TO HOWMANY
600 CALL CLEAR
610 PRINT "ENTER WORD";X
620 INPUT "      ":TOSPELL$(X)
630 SAID$(X)=TOSPELL$(X)
640 PRINT #1:"^"&SAID$(X)
650 PRINT "PRESS 'Y' IF SAID OK"
660 CALL KEY(0,KEY,STATUS)
670 IF STATUS=0 THEN 660
680 IF KEY=89 THEN 730
690 IF KEY=121 THEN 730
700 PRINT "ENTER WORD MORE PHONETI
    CALLY"
710 INPUT "      ":SAID$(X)
720 GOTO 640
730 PRINT "ENTER A SENTENCE"
740 INPUT "":SENTENCE$(X)
750 IF LEN(SENTENCE$(X))=0 THEN 82
    0
760 PRINT #1:SENTENCE$(X)
770 PRINT "PRESS 'Y' IF THAT WAS O
    K"
780 CALL KEY(0,KEY,STATUS)
790 IF STATUS=0 THEN 780
800 IF KEY=89 THEN 820
810 IF KEY<>121 THEN 730
820 NEXT X
830 ASK=1
840 FOR X=1 TO HOWMANY
850 CALL CLEAR
860 PRINT #1:"^"&ASK$(ASK)
870 FOR Y=1 TO TRIES
880 PRINT #1:"^"&SAID$(X)
890 PRINT #1:SENTENCE$(X)

```

```

900 FOR D=1 TO 50
910 NEXT D
920 PRINT #1:"^"&SAID$(X)
930 INPUT "      ":SPELLED$(X)
940 IF LEN(SPELLED$(X))>0 THEN 970
950 PRINT #1:"I ^SAID"
960 GOTO 890
970 RIGHT(X)=RIGHT(X)+1
980 IF SPELLED$(X)=TOSPELL$(X) THEN
    1150
990 CALL SOUND(-111,111,1)
1000 IF Y<>TRIES THEN 1110
1010 PRINT #1:"^NO"
1020 PRINT #1:"^"&SAID$(X)&" _IS_SPE
    LLED"
1030 PRINT
1040 FOR Q=1 TO LEN(TOSPELL$(X))
1050 PRINT #1:"^"&USEG$(TOSPELL$(X),
    Q,1)
1060 CALL HCHAR(24,7+Q,ASC(SEG$(TOS
    PELL$(X),Q,1)))
1070 NEXT Q
1080 FOR D=1 TO 1000
1090 NEXT D
1100 GOTO 1140
1110 PRINT #1:WRONG$(INT(RND*3+1))
1120 FOR D=1 TO 25
1130 NEXT D
1140 NEXT Y
1150 ASK=INT(RND*3+1)
1160 NEXT X
1170 CALL CLEAR
1180 PRINT "      PROBLEM WORDS"
1190 PRINT
1200 FOR X=1 TO HOWMANY
1210 SPELLED$(X)=SPELLED$(X)
1220 IF TOSPELL$(X)<>SPELLED$(X) THE
    N 1250
1230 SPELLED$(X)=" "
1240 IF RIGHT(X)=1 THEN 1260
1250 PRINT TOSPELL$(X);RIGHT(X);SPE
    LLS$
1260 NEXT X
1270 END

```




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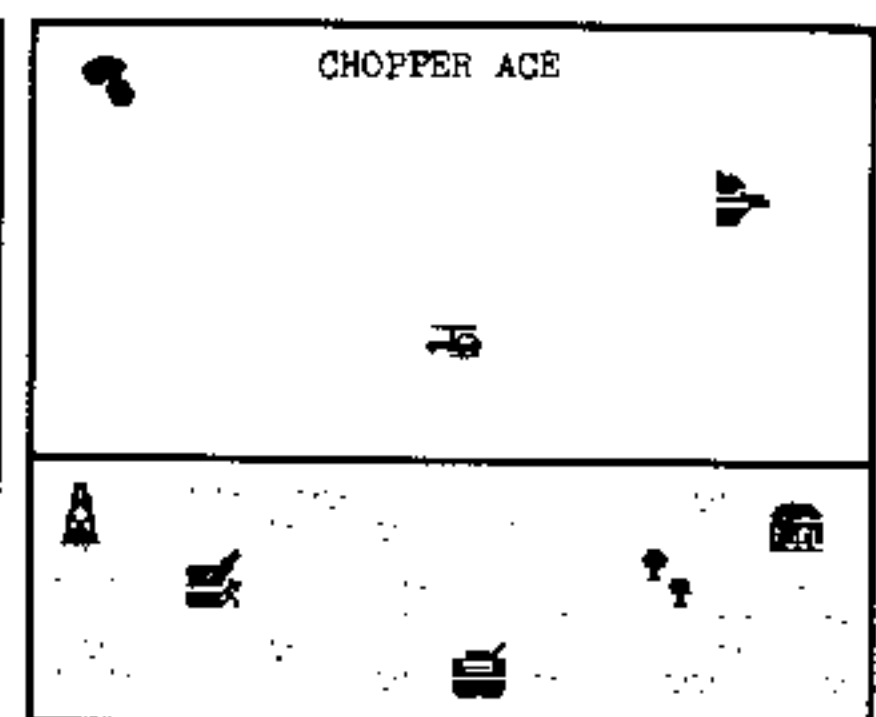
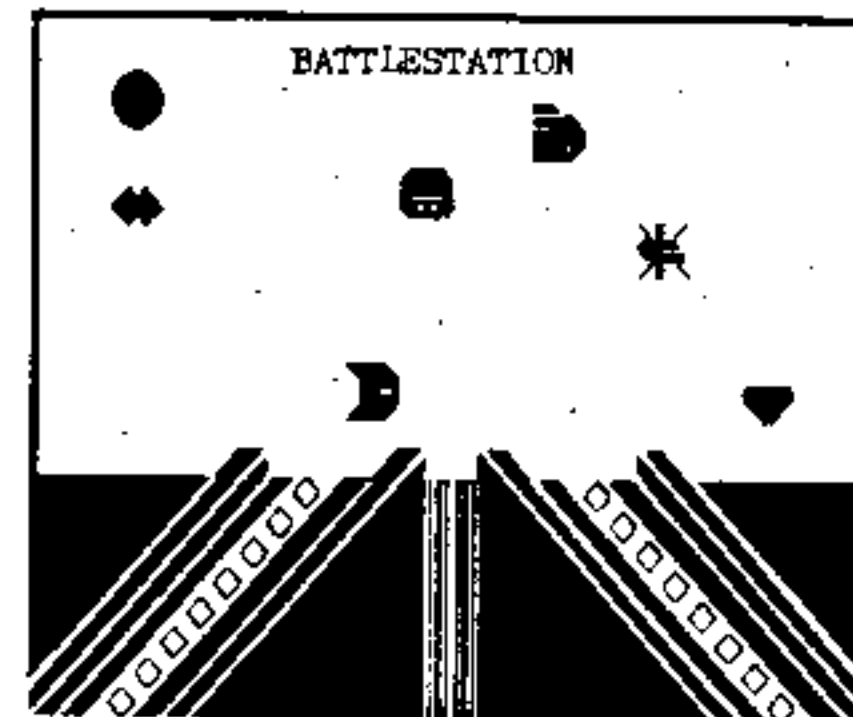
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PART II: SOFTWARE FOR THE RS232 INTERFACE THROUGH THE TI-99/4A JOYSTICK PORT

By Paul Urbanus

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This is the second part of a series on converting the joystick port of the TI-99/4A into a low-cost printer interface. The last article (June, 1983) presented construction plans for the hardware required.

At this point in the project, you've built the hardware—all you need is software to complete the system. The source code for the controlling Assembly Language program, Listing 1, is intended to run in Mini Memory. Most Mini Memory owners have limited systems, so the program has been designed to load with an absolute origin at the initial assembly load point in the Mini Memory cartridge (>7118). Listing 2 is the object (machine) code, which you can enter using EASYBUG. (Be sure to re-initialize the Mini Memory before entering any code.) After you've entered all the code, add the program names and entry addresses to the REF/DEF table starting at address >7FF0. The name and address data is given at the end of the program listing. You also have to set the RAM pointers starting at location >701C in Mini Memory to the values shown at the end of the assembly listing.

The Software

Because speed is essential for this output operation, the controlling software program is in TMS9900 Assembly Language. This program prints a string passed to it from a CALL LINK statement in a TI BASIC program. The main program loop is shown in Listing 1, Sections K, L, M and N. This program uses registers in the faster console CPU RAM. To preserve the BASIC environment, you must save the data in this register area into a temporary buffer. (Before control returns to the BASIC program, this memory must be restored.) Once the BASIC environment has been saved, the program gets the string from BASIC and stores it in a buffer, using the STRREF utility located in the Mini Memory cartridge. The program then calculates the number of control bits. At this point, one character from the string is removed from the string buffer and has start, stop, and parity control bits added. This character—now a piece of data in its final form—is sent to the subroutine that performs the actual character transmission. If the buffer is empty when the next character is requested, the BASIC register data is rolled back in, and control returns to BASIC.

The character transmit subroutine, shown in Sections HH, II and JJ, performs several tasks. It must check the device busy

signal before the start of a character transmission. The CRU (Communications Register Unit) of the TMS9900 makes this check and sets the joystick select levels as well. If the device is continuously busy, the keyboard is scanned for the BREAK command in TI BASIC—[FCTN] [4]—about 3 times a second. If the break keys are pressed, BASIC register data is rolled back in, and control returns to BASIC. This is consistent with the operation of the TI RS232 peripheral. If the device is ready (not busy), the baud counter is loaded. The current bit to output is checked, and pin 7 of J1 is set to the proper level with a set/reset bit instruction. After a delay equal to the time necessary to transmit one bit, a check is made to see if all bits have been transmitted. If not, the baud counter is reloaded, and the process starts over again. If all bits have been output, control returns to the main Assembly Language routine.

Using Joytalk

Now that you have the hardware built and the software ready, the next step is to try it out. First, open the Joytalk case so voltage measurements can be made, disconnect the monitor/modulator cable from the computer, and connect the 5-pin plug from the Joytalk into the computer video output jack. Then plug the monitor/modulator cable into Joytalk's 5-pin DIN jack. Turn on the monitor, then the computer. Using a voltmeter, check for the negative voltage supply at the minus side of capacitor C4. Then check for the positive 12 volt supply at IC1 pin 5.

If the computer is not working normally with Joytalk plugged in, or one of the voltages is not present, recheck your wiring. If the wiring is correct, check the polarity of D1, D2, C3, and C4. Also check that the correct transistor connections were made. Once everything is working properly, plug in the RS232 connector from your printer to Joytalk's RS232 connector J4.

To test your Joytalk interface, you'll call two Assembly Language programs from TI BASIC. The first of these sets up the RS232 parameters. These parameters include: baud rate (110 to 19200), stop bits (1 or 2), parity (space, mark, even, odd or none), suppression of automatic carriage return/line feed, suppression of line feed only, and number of data bits (7 or 8). Figure 1 shows how to calculate the number which specifies the desired parameter. (The example given calculates the parameter value for 1200 baud, 1 stop bit, odd parity and 7 data bits.) Once you've calculated this number, it is passed to the parameter-setting subroutine by the following TI BASIC statement:

```
CALL LINK("JSET",numeric expression or variable)
```


PARAMETER	VALUE	ADD VALUE
BAUD RATE		
110	0	
150	1	
300	2	
600	3	
1200	4	4
2400	5	
4800	6	
9600	7	
19200	8	
USER1	9	
USER2	10	
...	...	
USER7	15	
DATA BITS		
7	0	0
8	16	
PARITY		
SPACE	0	
MARK	32	
EVEN	64	
ODD	96	96
NONE	128	
STOP BITS		
ONE	0	0
TWO	256	
AUTO CARR RET		
ENABLED	0	0
DISABLED	512	
AUTO LINE FEED		
ENABLED	0	0
DISABLED	1024	
TOTAL		100

FIG. 1 PARAMETER VALUE CALCULATION:
1200 BAUD, 1 DATA BIT, ODD PARITY, 1 STOP BIT,
AUTO CR&LF

The second subroutine you call from TI BASIC is a string output routine. It outputs through the joystick port the contents of the string passed to it by TI BASIC. The software will add and send out carriage returns and line feeds if you set the proper parameters (*enable* carriage returns and line feeds). The format of the TI BASIC statement for string output is

CALL LINK("JOUT",string expression or variable)

The following short program tests the Joytalk interface. This test uses the following parameters: 7 bits, odd parity, 1200 baud, 1 stop bit. Other combinations of parameters could be used, however.

```
100 REM 7 DATA BITS 1 STOP BIT ODD PARITY 1200 BAUD
110 CALL LINK("JSET",100)
120 INPUT A$
130 REM OUTPUT STRING TO JOYSTICK RS232
140 CALL LINK("JOUT",A$)
150 GOTO 120
```

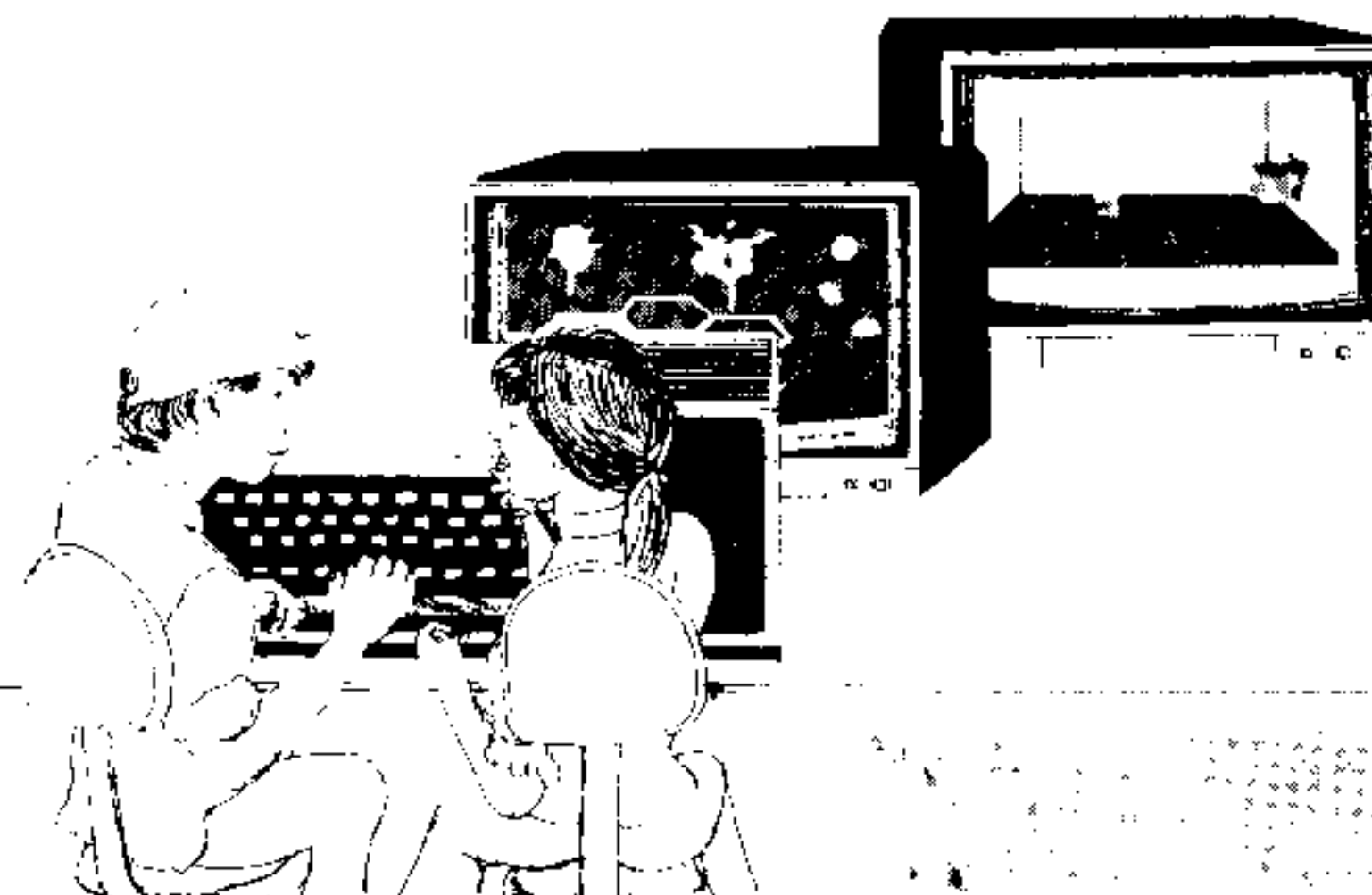
All calls to the Joytalk software must use the CALL LINK statement. You cannot access the Joytalk software through the TI BASIC PRINT statement because no other software entry points are provided.

User-Defined Baud Rates

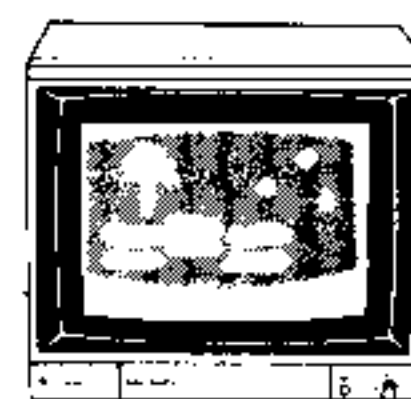
Although all the standard baud rates are available with the Joytalk program, provisions are included to allow you to program your own baud rates. To calculate the new baud counter value, first calculate the time (microseconds) of one data bit. This time is equal to $1,000,000/(\text{baud rate})$. Using this time (BTIME), calculate two numbers (X, Y) using the following formula:

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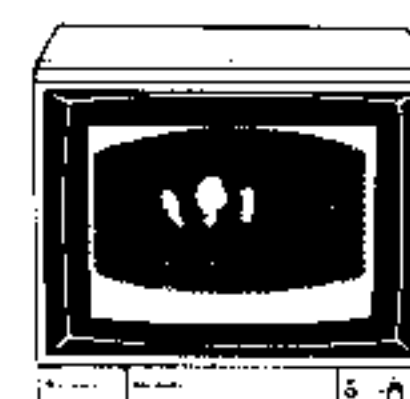


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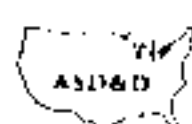
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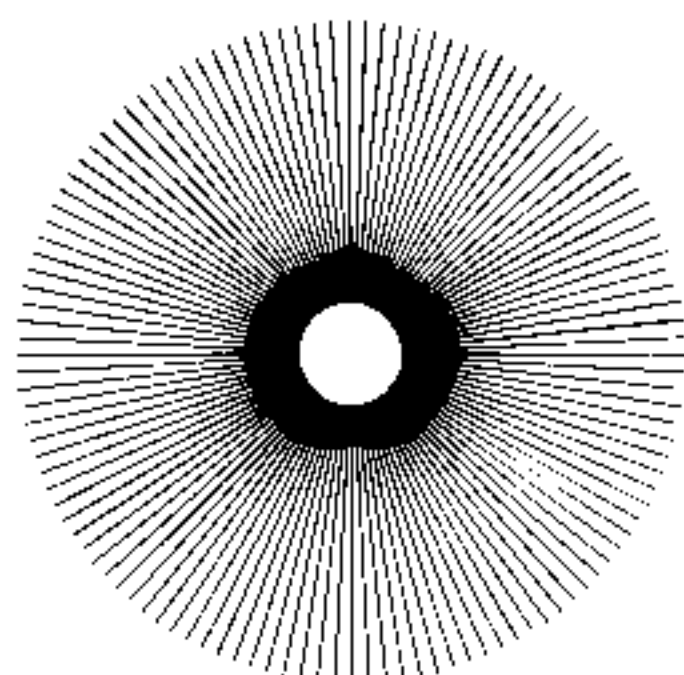
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with $0 < X < 4096$ and $0 < Y < 15$. After you've calculated X and Y, join them to form one 16-bit word with the following formula:

$$BAUD\ TABLE\ VALUE = X + Y*4096$$

You need to enter new values into the baud rate table beginning at USERBD (>7404). Each user will take one 16-bit word. USER1 will occupy the word beginning at >7404; USER2 will occupy the word >7406, and so on. To implement these USER baud rates, merely incorporate the appropriate value from Figure 1 when calculating the RS232 parameter.

Comments

Well, you now have a low-cost serial interface which allows you to talk to the outside world through TI BASIC—or Assembly Language if you modify the program. And you still have about 3K of unused RAM in the Mini Memory cartridge just waiting to be filled . . .

In the previous section of Joytalk (June 1983), the schematic diagram on page 65 (Fig 4.) had some components inadvertently switched. Debugs, on page 76 in this issue, contains a corrected diagram.

Listing 1

TITLE 'JOYSTICK RS232'

```
*
*
* RS232 OUTPUT THRU JOYSTICK
*
* BY PAUL URBANUS
*
*** SYSTEM EQUATES
*
PAD EQU >8300 START OF FAST 16 BIT CPU RAM
FAC EQU PAD+>4A FLOATING ACCUMULATOR
KUNIT EQU PAD+>74 KEYBOARD # TO BE SCANNED
KCODE EQU PAD+>75 KEYCODE IS RETURNED
STATUS EQU PAD+>7C GPL/SYSTEM STATUS FLAGS
GPLWS EQU PAD+>E0 SYSTEM WORKSPACE
FASTWS EQU PAD SOFT 232 WORKSPACE AT START OF RAM
*
*** BASIC UTILITIES IN MINI MEMORY ROM
*
NUMREF EQU >6044 * UTILITY VECTORS
STRREF EQU >604C * FOR ROUTINES
XMLLNK EQU >601C * LOCATED IN
ERR EQU >6050 * MINI MEMORY ROM
*
*
* ADDR >7118 START OF AVAILABLE MINI MEMORY RAM
*
*
* EVEN
*
*** MISCELLANEOUS MASKS AND DATA EQUATES
*
STPSTB DATA >0100 A STOP BITS MASK
PARMK1 DATA >00B0 * PARITY
PARMK2 DATA >0040 * MASK
PARMK3 DATA >0020 * BITS
GTYSK DATA >0010 NUMBER OF DATA BITS MASK
BAUDMK DATA >000F BAUD TABLE INDEX MASK
LFMASK DATA >0200 AUTO LINE FEED MASK
CRMASK DATA >0400 AUTO CARRIAGE RETURN MASK
PARBIT DATA >0100 DEFAULT PARITY BIT POSITION
STRMSK DATA >0001 START BIT MASK
STPMSK DATA >0700 STOP BIT MASK
H0001 DATA >0001 USED IN PARITY SETTING ROUTINE
H00 BYTE >00
HFF BYTE >FF
*
*** RAM BUFFERS AND RAM VARIABLES
*
BSCBUF BSS 32 ROLLOUT MEMORY FOR FAST RAM
*
STRBUF BSS 256 INPUT DATA BUFFER
*
STATRS DATA >0062 B RS232 PARAMETER WORD
BSCRET BSS 2 BASIC RETURN ADDR SAVE LOC.
*
*
*****
*
* CRU INIT SUBR
*
* CALLED BY: BL @SETUP
*
* REG USE: R1,R12
*
* SET R12 CRU BASE TO POINT TO SCAN MATRIX DECODER
* SET SCAN DECODER TO SELECT JOYSTICK 2(JS2=0V)
* THIS ACTION GATES BUSY ONTO THE DOWN INPUT OF THE
* JOYSTICK INPUT BUSS.
*
*****
```



```

EVEN
*
PIN7AD EQU 36          ADDR OF SCAN MATRIX DECODER
PIN7EN EQU >0700      TURN ON LAST DECODER OUTPUT
*
SETUP LI R12,PIN7AD    C LOAD CRU ADDRESS OF DECODER
      LI R2,PIN7EN      SELECT PIN 2 ON JOYSTICK PORT
      LDCR R2,3         ...AND SET IT TO GROUND
      RT
*
*****
* SUBROUTINE TO GET AN INPUT STRING FROM BASIC
*
*   REGISTERS AFFECTED:
*
*   R0 - ZDT
*   R1 - ZDT
*   R2 - ZDT
*   R7 - RETURNS STRING BUFFER POINTER
*   R8 - RETURNS STRING LENGTH
*
*****
GETSTR EQU *
      CLR R0            D GET STRING PARAMETER
      LI R1,1           GET FIRST (AND ONLY) PARAMETER
      LI R2,STRBUF      LOAD BUFFER POINTER
      MOV8 @HFF,*R2     MAX BUFFER LEN = 255
      BLNP @STRREF      GET STRING
      MOV R2,R7         COPY BUFFER POINTER
      MOV8 *R7+,R8      GET LENGTH BYTE
      SRL R8,8          RIGHT ADJUST LENGTH BYTE
      RT
*
*****
*   SAVE AND LOAD LOOPS FOR FAST RAM SAVE/LOAD
*
*   CALLED BY: BL @SAVEIT - SAVE FAST RAM DATA IN
*               EXTERNAL BUFFER
*
*               BL @RESTOR  RESTORE FAST RAM DATA
*               FROM EXTERNAL BUFFER
*
*   REGISTER USAGE: R0,R1,R2
*
*****
SAVEIT EQU *
      LI R0,FASTWS      E SET LOAD POINT IN FAST RAM
      LI R1,BSCBUF      LOAD START OF CODE TO BE MOVED
      JMP MOVENT         JUMP AND DO BLOCK MOVE
*
RESTOR EQU *
      LI R0,BSCBUF      F THIS TIME BUFFER IS SOURCE
      LI R1,FASTWS      AND FAST RAM IS DESTINATION
      MOV8 R2,32         32 BYTES TO SAVE/RESTORE
      MOVLP1 MOV *R0+,*R1+ MOVE TWO BYTES OF CODE
      DECT R2            DECREMENT BLOCK LENGTH CNTR
      JNE MOVLP1         IF NOT DONE, MOVE TWO BYTES
      RT                PASS CONTROL TO OUTPUT ROUTINE
*
*****
*   SET UP RS 232 PARAMETERS FROM BASIC
*
*   THIS ROUTINE INPUTS A NUMERIC VALUE AND USES THIS
*   VALUE TO SPECIFY THE RS232 PARAMETERS
*
*   CALLED IN BASIC BY: CALL LINK("JSET",<num expr/var>)
*
*****
H03 BYTE 3          G ERROR CODE RETURNED FROM
*                   CONVERT FLT-PT TO INTEGER
*
EVEN                H MAX VALUE OF SETUP INTEGER
MAXSET DATA >0800
*
JSET CLR R0          I ZERO FOR SCALAR NUMERIC
      LI R1,1         PICK UP FIRST AND ONLY PARAM
      BLNP @NUMREF    GET THE NUMERIC PARAMETER
      BLNP @XMLLNK    GO TO CONSOLE ROM CODE TO...
      DATA >1200     ...CONVERT FLTPT TO INTEGER
      CB @H03,@FAC+10 CHECK FOR OVERFLOW ERROR
      JEQ BADV        INDICATE ERROR TO USER
      C @FAC,@MAXSET  IS PARAMETER OUT OF RANGE
      JHE BADV        IF YES, JUMP AND INDICATE IT
      MOV @FAC,@STATRS SAVE NEW RS232 SETUP PARAMS.
      RT              BYE! BYE!
*
BADVAL EQU >1300     "BAD VALUE" ERROR MESSAGE
*
BADV EQU *
      LI R0,BADVAL    J LOAD BAD VALUE POINTER
      BLNP @ERR        CALL ERROR HANDLER
*
*****
* JOYSTICK OUTPUT (MAIN ROUTINE)
*
* CALLED IN BASIC BY: CALL LINK("JOUT",<str exp/str var>)
*
* REGISTER USAGE
*
* R0 = VARIABLE SHIFT COUNT
* R1 = DATA IN MSBYTE

```

Continued on p. 37

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DARWINIAN EVOLUTION AT WORK IN CE INDUSTRY

The intensely competitive consumer electronics industry has created its own species of dinosaur in merely a few months. Several large video game manufacturers who exhibited during the January CES were out of business or in Chapter 11 by the time of the recent Chicago show. Surviving software producers are more intent on additional translations of previously released games for other machines than on producing new games—hence the attraction of the 99/4A with a user base of over 1 million units. Multiple-format release is consistent with mass-market strategy.

HOLIDAY SEASON BECKONS ADDITIONAL PLAYERS IN HOME COMPUTER GAME

The door to entry in the home computer business will be slamming shut after the year-end holiday purchasing season winds down. The assortment of machines found in department and discount stores is expected to reach a peak this season before next year's shake-out takes place. Spectravideo, Coleco, Mattel, Tomy, IBM and Apple will be competing for space and visibility with Texas Instruments, Commodore, Atari, Timex, and the Japanese. If the newcomers don't make it in the door this season, the economy of scale and the established software base necessary to compete in the mid-80's will not be forthcoming—unless the new player has its own multi-thousand store retail chain.

THE SEARCH FOR THE "NEW CONSUMER" ENTICES HC MAKERS

June CES saw Coleco and Atari introduce complete systems to be sold as one store-keeping unit. TI and others are expected to follow suit as products are ready to be shipped. Although many industry analysts feel that the show announcements were premature—since ship dates by this fall in the quantities needed don't seem realistic—all the major players see higher-priced "systems" as one way out of unprofitable price-war situations. Marketing of the systems will be directed to a new base of consumers who are less price conscious and more concerned with utility extending beyond entertainment. Home productivity packages such as word processors and database/filing programs are likely to be bundled with the CPU, data storage device, and companion printer.

MARKETING REPLACES SELLING AS INDUSTRY MATURES

The principal HC manufacturers have realized that the now multi-billion dollar personal computer industry requires different players and a different game plan than for the previous multi-million dollar business. The industry has, since conception, been driven by R & D—thus relying on selling products that the "boys in the backroom" have cooked up. The mass-consumer market we're now seeing requires a switch to focusing on buyer needs, and designing products accordingly. Industry watchers thus expect more marketing execs to be brought over from the more mature consumer product industries.

MORE BIG NAMES JUMP ON TI'S SOFTWARE PUBLISHING BANDWAGON

Despite the protests and rash of hostile publicity TI incurred as a result of its GROM-patent stance as relating to cartridge production, major software producers are now coming on line with agreements to let Lubbock license, manufacture, and distribute. Imagic, an industry leader, has agreed to seven initial titles including Microsurgeon and Demon Attack—its "Game of the Year." From Fox Video comes M*A*S*H; from Broderbund comes its two blockbusters—Chop Lifter and David's Midnight Magic. Other big names such as Activision, Sega, and Sierra On-Line are expected to follow suit—enticing by TI's strong market share, and eager to get a timely leg up on the competition by steering clear of anticipated lawsuits.

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JoyTalk... from p. 35

```

* R2 = TEMP, SCRATCH SHIFT
* R3 = BAUD COUNTER (LOOP PERMANENT)
* R4 = LOOP COUNTER VARIABLE (BITCNT)
* R5 = TEMP VARIABLE FOR BITLOOP
* R6 = PERMANENT BIT COUNT
* R7 = BUFFER POINTER
* R8 = BUFFER LENGTH
* R9 = 3RD LEVEL (INNERMOST) SUBROUTINE LINK
* R10 = 2ND LEVEL SUBROUTINE LINK
* R11 = 1ST LEVEL (OUTERMOST) SUBROUTINE LINK
*
*****
*
*
JOUT EQU $
LIMI 0
MOV R11, @BSCRET K SAVE LINK TO BASIC
BL @GETSTR GET THE BASIC STRING
BL @SAVEIT SAVE FAST RAM CONTENTS
MOV R7, @FASTWS+14 PASS BUFFER POINTER..
MOV R8, @FASTWS+16 ...AND BUFFER LENGTH
LWPI FASTWS GET READY TO GO FASTER!!!
BL @BITCNT FIND NUMBER OF BITS TO X-MIT
BL @SETUP SET UP JOYSTICK MUX

FETCH2 EQU $
MOVB *R7+, R1 L GET NEXT CHAR FROM BUFFER
DEC R8 ADJUST REMAINING CHAR COUNT
JLT RET2
BL @OUTCHR ADJUST & OUTPUT ONE CHAR
JMP FETCH2 ...AND LOOP IN NOT END OF STR.

RET2 EQU $
BL @CKAUTO M CHECK AUTOMATIC OPTIONS
BRKRET EQU $ RETURN ENTRY IF BREAK KEY DOWN
LWPI STRBUF N TEMP REGS TO RESTORE FAST RAM
BL @RESTOR RESTORE DATA FOR BASIC
MOV @BSCRET, R11 RESTORE CALLER ADDRESS...
MOVB @H00, @STATUS CLEAR ERROR IN CASE OF BREAK
RT ...AND RETURN

*
*
*****
* DATA OUTPUT ROUTINE
*
* CALLED BY: BL @OUTCHR
*
* THIS ROUTINE DOES SEVERAL THINGS:
*
* 1. ADDS CONTROL BITS (START/STOP/PARITY) TO DATA
* 2. GETS CURRENT BAUD RATE VALUE
* 3. OUTPUTS THE CHARACTER
*
*
*****
*
*
OUTCHR EQU $
MOV R11, R10 O SAVE SUBROUTINE LINK
SRL R1, 8 RIGHT ADJUST OUTPUT BYTE
BL @PARSET SET UP START, STOP, & PARITY
* BITS IN DATA BYTE
BL @GETBD P GET BAUD RATE AND SHIFT COUNT
MOV R6, R5 COPY # BITS FROM PERMANENT REG
BL @SENDIT TRANSMIT THE DATA
B *R10 RETURN TO CALLER

*
*
*****
* AUTOMATIC CARRIAGE RETURN & LINE FEED
*
* CALLED BY: BL @CKAUTO
*
* THIS ROUTINE CHECKS THE PARAMETER WORD AND SENDS
* A CARRIAGE RETURN OR LINE FEED IF ENABLED TO DO SO
*
*
*****
*
*
CRLF BYTE >0D, >0A Q DATA FOR AUTO CR & LF
EVEN
CKAUTO EQU $
MOV R11, R9 R SAVE SUBROUTINE LINK
MOV @STATRS, R3 COPY STATUS WORD
CZC @CRMASK, R3 IS AUTO CARR RET ENABLED.
JNE CHKLF IF NOT, CHECK FOR LINE FEED
MOVB @CRLF, R1 COPY CARRIAGE RETURN CODE
BL @OUTCHR OUTPUT CARRIAGE RETURN
MOV @STATRS, R3 RESTORE PARAMETERS IN REG
CHKLF CZC @LFMASK, R3 WHAT ABOUT LINE FEED?
JNE AUTORT RETURN IF NOT ENABLED
MOVB @CRLF+1, R1 GET LINE FEED ASCII CODE
BL @OUTCHR AND SEND IT
AUTORT EQU $
B *R9 S RETURN

```

Continued on p. 40

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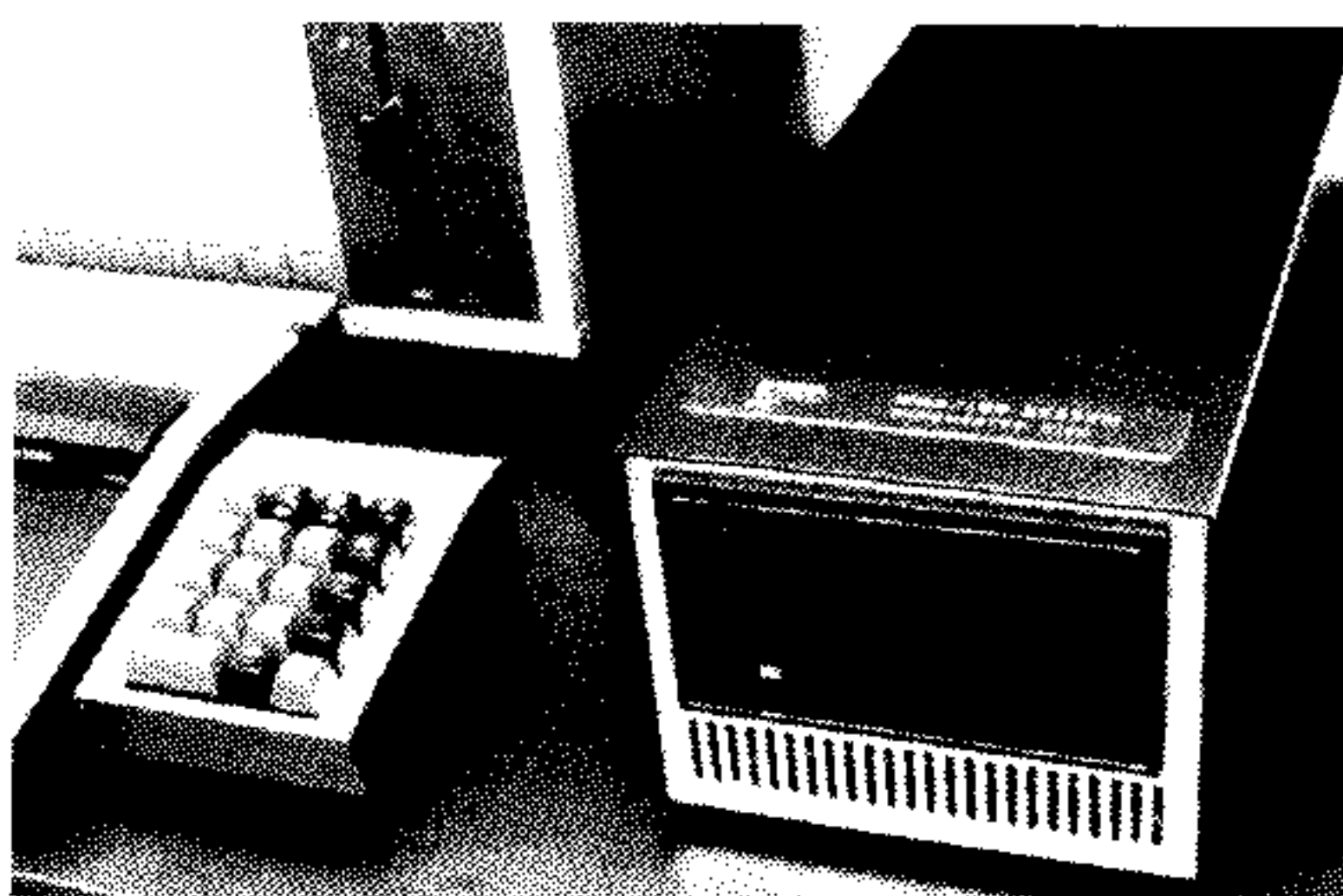
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[illegible]

CALLER BY: BL @PARSET

THIS SUBROUTINE MODIFIES THE DATA IN R1L9BYTE

1. ADJUSTS FOR DATA LENGTH(7 OR 8 DATA BITS)
2. INSERTS THE CORRECT NUMBER OF STOP BITS(1 OR 2)
3. INSERTS THE START BIT
4. CALCULATES AND INSERTS THE PARITY BIT(IF SELECTED)

REGISTER USAGE: R0-R4

R1 - RETURNS DATA WITH CONTROL BITS READY FOR SHIFTER

PARSET	EQU	\$			
	MOV	@BSTATUS,R3	T		COPY RS232 STATUS WORD
	COC	@PARMK1,R3			IS PARITY DESIRED?
	JEQ	RETPAR			RETURN IF NOT NEEDED.
	COC	@PARMK2,R3			CHECK IF NEED TO CALC PARITY
	JEQ	CALCPA			IF SO, JUMP AND DO IT
FXDPA	MOV	R3,R4			NO PARITY CALC, SO SET IT(0/1)
	SRL	R4,5			MOVE PARITY STATE TO LSBIT
	JMP	PBIT			JUMP AND SET THE BIT
CALCPA	EQU	\$			
	CLR	R4	U		CLEAR PARITY FLAG
	COC	@QTYMSK,R3			IS IT REALLY 8 DATA BITS?
	JEQ	CHKPAR			IF SO, JUMP AND CHECK 1ST BIT
	ANDI	R1,>007F			MAKE SURE 8TH BIT IS ZERO
CHKPAR	EQU	\$			ENTRY POINT TO CALC PARITY
	MOVB	@FASTWS+3,R2	V		MAKE R1LSBYTE AFFECT PARITY
	JOP	CHKEVN			PARITY SET FOR ODD, SO JUMP
	INC	R4			SET LSBIT FOR ODD PARITY
CHKEVN	EQU	\$			
	COC	@PARMK3,R3	W		CHECK EVEN/ODD PARITY?
	JEQ	PBIT			IF ODD PARITY, ITS SET UP OK
	XOR	@H0001,R4			INVERT PARITY BIT/MAKE IT EVEN
PBIT	EQU	\$			
	LI	R0,7	X		DEFAULT SHIFT FOR PARITY MASK
	CZC	@QTYMSK,R3			CHECK 7 OR 8 DATA BITS
	JEQ	PBIT2			JUMP IF 7 BITS
	INC	R0			ADJ SHIFT COUNT FOR 8 BITS
PBIT2	SLA	R4,0			POSITION PARITY BIT
	MOV	@H0001,R2			LOAD UP INITIAL MASK VALUE
	SLA	R2,0			LINE UP MASK BIT W/ PARITY BIT
	SZC	R2,R1			CLR OUT PARITY BIT, THEN...
	XOR	R4,R1			...MASK IN CORRECT VALUE
RETPAR	EQU	\$			
	SLA	R1,1	Y		MAKE ROOM FOR START BIT
	MOV	R6,R0			COPY NUMBER OF BITS TO SHIFT
	DEC	R0			
	CZC	@STPSTS,R3			IS IT ONE OR TWO STOP BITS?
	JEQ	SHFIT2			JUMP IF ONLY ONE STOP BIT
	DEC	R0			2 STOP BITS, SO ADJ SHIFT CNT
SHFIT2	EQU	\$			
	LI	R2,>0003	Z		LOAD STOP BIT MASK
	SLA	R2,0			PUT STOP BITS IN PROPER PLACE
	SOC	R2,R1			NOW SET THE STOP BIT(S) UP
	RT				

BIT COUNT SUBROUTINE

CALLER BY: BL @BITCNT


```

* REGISTER USAGE:
*
* R0 - DESTROYED
* R6 - RETURNS TOTAL NUMBER OF BITS TO SEND
*
* R6 = DATA LENGTH(7 OR 8) + 1 START BIT
* + #STOP BITS(1 OR 2) + PARITY BITS(0 OR 1)
*****
BITCNT EQU $
MOV @STATRS,R0 AA COPY PARAMETER WORD
LI R6,9 LOAD DEFAULT BIT COUNT FOR
*** 1 STOP BIT, 1 START BIT AND
*** NO PARITY BIT, 7 DATA BITS
COC @STPSTS,R0 BB IS IT ONE OR TWO STOP BITS?
JNE BITS10 JUMP IF ONE STOP BIT
INC R6 MAKE BIT COUNT=11
BITS10 EQU $
COC @PARMK1,R0 CC CHECK FOR PARITY
JEQ BITS11 JUMP IF NO PARITY SET
INC R6 ADJUST BIT CNT TO INCL PARITY
BITS11 EQU $
COC @QTYMSK,R0 DD CHECK FOR A 8 DATA BITS
JNE BITS12 IF DATA BITS=7, THEN JUMP
INC R6 ADJUST BIT CNT TO INCL 8 DBITS
BITS12 EQU $
RT EE RETURN TO CALLER
*
*****
* GET BAUD RATE FROM TABLE
*
* CALLED BY: BL @GETBD
*
* REGISTER USAGE: R0,R3
*
* RETURNS: COARSE LOOP VALUE IN R0
* FINE TUNING VALUE IN R3
*****
GETBD EQU $
MOV @STATRS,R3 FF GET BAUD RATE INDEX FROM
ANDI R3,>000F TABLE AND MASK OFF UNEEDED BIT
SLA R3,1 MAKE MASKED VALUE WORD INDEX
MOV @BACNTR(R3),R3 GET BAUD COUNTER VALUE
MOV R3,R0 COPY BAUD RATE DATA
SRL R0,12 ADJUST SHIFT COUNT INTO R0
ANDI R3,>0FFF
RT
*
*****
* SOFTWARE BIT TIMER VALUES
*
*****
BACNTR DATA 0*4096+970 GG 110 BAUD
DATA 0*4096+710 150 BAUD
DATA 0*4096+353 300 BAUD
DATA 2*4096+174 600 BAUD
DATA 12*4096+84 1200 BAUD
DATA 3*4096+40 2400 BAUD
DATA 13*4096+17 4800 BAUD
DATA 10*4096+6 9600 BAUD
DATA 2*4096+1 19200 BAUD
USERBD EQU $ FIRST USER BAUD RATE(USER1)
ENDCNT EQU *-BACNTR
BSS 32-ENDCNT SPACE FOR ADDITIONAL CUSTOM
USER BAUD RATES
*
*****
* SEND ONE CHARACTER
*
* CALLED BY: BL @SENDIT
*
* FAST LOOP TO TRANSMIT ONE CHARACTER THRU
* THE JOYSTICK PORT
*
* IF THE RECEIVING DEVICE IS BUSY, THE KEYBOARD IS
* SCANNED APPR. EVERY 1/3 SEC FOR THE CLEAR KEY(FCTN 4),
* WHICH IS ALSO THE BASIC 'BREAK' KEY.
*
* IF THE CLEAR KEY IS PRESSED, CONTROL RETURNS TO BASIC
* AND NO MORE CHARACTERS ARE SENT
*
* REGISTER USAGE:
*
* R0 - VARIABLE SHIFT COUNT FOR FINE TIMING CONTROL
* R1 - CONTAINS DATA TO BE SHIFTED OUT
* R2 - DUMMY REGISTER USED IN VARIABLE COUNT SHIFT
* R3 - VALUE OF ONE BIT TIME WHICH IS PRESERVED
* R4 - DECREMENT REGISTER FOR BIT TIME COUNTER
* R5 - NUMBER OF BITS TO TRANSMIT
*
*****
BRKKEY BYTE >02 HH CODE FOR 99/4 CLEAR KEY
*
EVEN
SENDIT EQU $

```

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```
BUSYIN L1 R2,>4000 II LOAD TIME BETWEEN BREAK CHECKS
BUSYLP DEC R2 COUNT DOWN ONE AT A TIME
JNE TESTIT BREAK CHECK NOT READY SO JUMP
MOV @GPLWS+22,R2 SAVE GPL RETURN LINK
LWPI GPLWS LOAD UP SYSTEM WORKSPACE
MOVB @H00,@KUNIT SCAN KEYBOARD ZERO
BL @>000E GO TO CONSOLE ROM CODE
LWPI FASTWB RETURN TO RS232 WORKSPACE
MOV R2,@GPLWS+22 RESTORE SYSTEM RETURN ADDRESS
MOV R11,R13 SAVE SUBROUTINE LINK
BL @SETUP TURN ON DEVICE BUSY GATE
MOV R13,R11 RESTORE SUBROUTINE LINK
CB @BRKKEY,@KCODE WAS BREAK KEY PRESSED?
JNE BUSYIN NO, SO CHECK BUSY LINE AGAIN
B @BRKRET RETURN TO BASIC
TESTIT TB -12 SEE IF THE DEVICE IS BUSY
JEQ BUSYLP IF SO, MAYBE NEED TO CHK BREAK
NXTBIT SRC R1,1 MOV ONE BIT INTO CARRY
JOC SETONE IF BIT IS ONE, JUMP & OUTP 1
SBZ 0 BIT WAS ZERO, SO SET OUTP TO 0
JMP BITDLY JUMP AND DELAY ONE BIT TIME
SETONE SBO 0 SEND A '1' BIT
JNC #+2 MAKE TIMING SAME BOTH WAYS
BITDLY MOV R3,R4 GET THE BAUD DECREMETER COUNT
BITLP DEC R4 BAUD COUNTER LOSES ONE...
JNE BITLP ...LOOP AGAIN IF NOT TIMED OUT
SRC R2,0 THIS ALLOWS FINE TUNING OF
OF THE TIME WITH 2/3 US RESOL
DEC R5 BIT COUNTER LOSES ONE.
JNE NXTBIT IF ALL BITS NOT OUTP., RE-LOOP
RT
ENDADR EQU $
*
* MINI MEMORY USERS SHOULD ENTER THE FOLLOWING DATA IN THE
* REF/DEF TABLE & 'MEMORY AVAILABLE' POINTERS
*
AORG >7FF0
EVEN KK
BYTE 'J','D','U','T',' ' NAME FOR REF/DEF TABLE
DATA JOUT ADDRESS TO BRANCH ON NAME LINK
BYTE 'J','S','E','T',' ' PARAMETER SET ROUTINE
DATA JSET ENTRY ADDRESS
*
AORG >701C
DATA ENDADR LL FIRST FREE ADDRESS IN MINI MEM
DATA >7FF0 BOTTOM OF REF/DEF TABLE
DATA 0 NO DEFAULT ENTRY ADDRESS
DATA 0,0,0,0 DON'T RECOGNIZE MEMORY EXPANEN
```

END

The following object code listing has two columns. The left-hand column has memory location addresses. Since the addresses given are all even hexadecimal numbers, they are word boundaries. The right-hand column contains the contents of that word in hexadecimal. Because EASYBUG's addressing increments by bytes, it only permits you to enter bytes. Thus, to enter the following data using EASYBUG, first access EASYBUG, then type M7118. Next, from the column opposite 7118, enter the *leftmost* two digits: 01. Pressing [ENTER] advances you to memory location 7119, the second byte of the word beginning at 7118. Now, from the column opposite 7118, type in the *rightmost* two digits: 00. Press [ENTER] again, 711A appears, and you repeat the process. The letters at the head of each section of this listing correspond to the letters on each grey section of Listing 1. This will allow you to compare the source code listing with the assembled object code.

JOYTALK LISTING 2

	Addr.	Cont.		Addr.	Cont.		Addr.	Cont.
A	7118	0100		725E	30C2		7282	7132
	711A	0080		7260	045B		7284	1004
	711C	0040						
	711E	0020	D	7262	04C0	F	7286	0200
	7120	0010		7264	0201		7288	7132
	7122	000F		7266	0001		728A	0201
	7124	0200		7268	0202		728C	8300
	7126	0400		726A	7152		728E	0202
	7128	0100		726C	D4A0		7290	0020
	712A	0001		726E	7131		7292	CC70
	712C	0700		7270	0420		7294	0642
	712E	0001		7272	604C		7296	16FD
	7130	00FF		7274	C1C2		7298	045B
				7276	D237	G	729A	0300
B	7252	0062		7278	0988			
				727A	045B	H	729C	0800
C	7256	020C						
	7258	0024	E	727C	0200	I	729E	04C0
	725A	0202		727E	8300		72A0	0201
	725C	0700		7280	0201		72A2	0001

Addr.	Cont.	Addr.	Cont.	Addr.	Cont.
72A4	0420	7342	7252	FF	73DA C0E0
72A6	6044	7344	24E0		73DC 7252
72A8	0420	7346	7124		73DE 0243
72AA	601C	7348	1604		73E0 000F
72AC	1200	734A	D060		73E2 0A13
72AE	9820	734C	732B		73E4 C0E3
72B0	729A	734E	06A0		73E6 73F2
72B2	8354	7350	7316		73E8 C003
72B4	1308	S 7352	0459		73EA 09C0
72B6	8820				73EC 0243
72B8	834A	T 7354	C0E0		73EE 0FFF
72BA	729C		7252		73F0 045B
72BC	1404		7358 20E0	GG	73F2 03CA
72BE	C820		735A 711A		73F4 02C6
72C0	834A		735C 1321		73F6 0161
72C2	7252		735E 20E0		73F8 20AE
72C4	045B		7360 711C		73FA C054
J 72C6	0200		7362 1303		73FC 3028
72C8	1300		7364 C103		73FE D011
72CA	0420		7366 0954		7400 A006
72CC	6050		7368 100F		7402 2001
K 72CE	0300	U 736A	04C4	HH	7412 0200
72D0	0000		736C 20E0		
72D2	C80B		736E 7120	II	7414 0202
72D4	7254		7370 1302		7416 4000
72D6	06A0		7372 0241		7418 0602
72D8	7262		7374 007F		741A 1617
72DA	06A0	V 7376	D0A0		741C C0A0
72DC	727C		7378 8303		741E 83F6
72DE	C807		737A 1C01		7420 02E0
72E0	830E		737C 0584		7422 83E0
72E2	C808				7424 D820
72E4	8310	W 737E	20E0		7426 7130
72E6	02E0		7380 711E		7428 8374
72E8	8300		7382 1302		742A 06A0
72EA	06A0		7384 2920		742C 000E
72EC	73B8		7386 712E		742E 02E0
72EE	06A0				7430 8300
72F0	7256	X 7388	0200		7432 C802
L 72F2	D077		738A 0007		7434 83F6
72F4	0608		738C 24E0		7436 C34B
72F6	1103		738E 7120		7438 06A0
72F8	06A0		7390 1301		743A 7256
72FA	7316		7392 0580		743C C2CD
72FC	10FA		7394 0A04		743E 9820
M 72FE	06A0		7396 C0A0		7440 7412
7300	732C		7398 712E		7442 8375
N 7302	02E0		739A 0A02		7444 16E7
7304	7152		739C 4042		7446 0460
7306	06A0	Y 73A0	0A11		7448 7302
7308	7286		73A2 C006		744A 1FF4
730A	C2E0		73A4 0600		744C 13E5
730C	7254		73A6 24E0		744E 0B11
730E	D820		73A8 7118		7450 1802
7310	7130		73AA 1301		7452 1E00
7312	837C		73AC 0600		7454 1002
7314	045B				7456 1D00
O 7316	C28B	Z 73AE	0202		7458 1700
7318	0981		73B0 0003		745A C103
731A	06A0		73B2 0A02		745C 0604
731C	7354		73B4 E042		745E 16FE
P 731E	06A0		73B6 045B		7460 0B02
7320	73DA	AA 73B8	C020	JJ	7462 0605
7322	C146		73BA 7252		7464 16F4
7324	06A0		73BC 0206		7466 045B
7326	7414		73BE 0009	KK	7FF0 4A4F
7328	045A				7FF2 5554
Q 732A	0D0A	BB 73C0	2020		7FF4 2020
R 732C	C24B		73C2 7118		7FF6 72CE
732E	C0E0		73C4 1601		7FF8 4A53
7330	7252		73C6 0586		7FFA 4554
7332	24E0	CC 73C8	2020		7FFC 2020
7334	7126		73CA 711A		7FFE 729E
7336	1606		73CC 1301	LL	701C 7468
7338	D060		73CE 0586		701E 7FF0
733A	732A	DD 73D0	2020		7020 0000
733C	06A0		73D2 7120		7022 0000
733E	7316		73D4 1601		7024 0000
7340	C0E0		73D6 0586		7026 0000
		EE 73D8	045B		7028 0000

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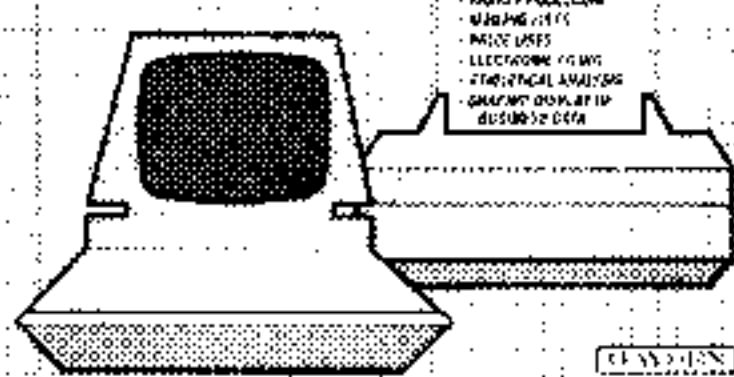
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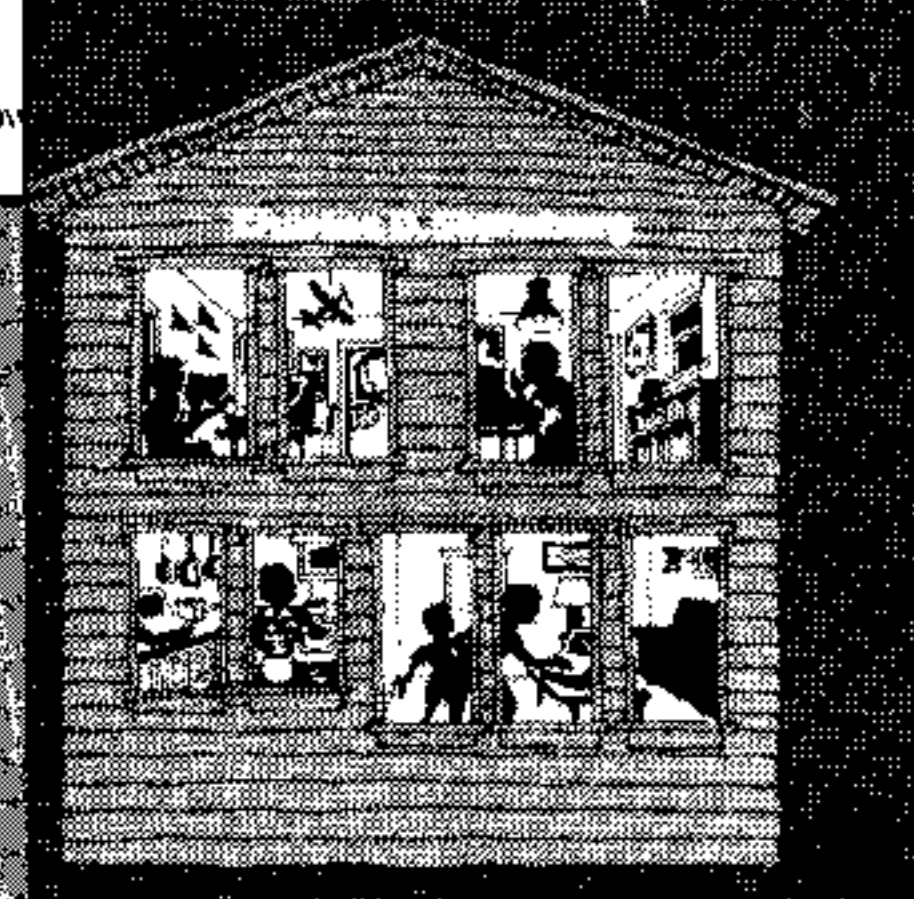
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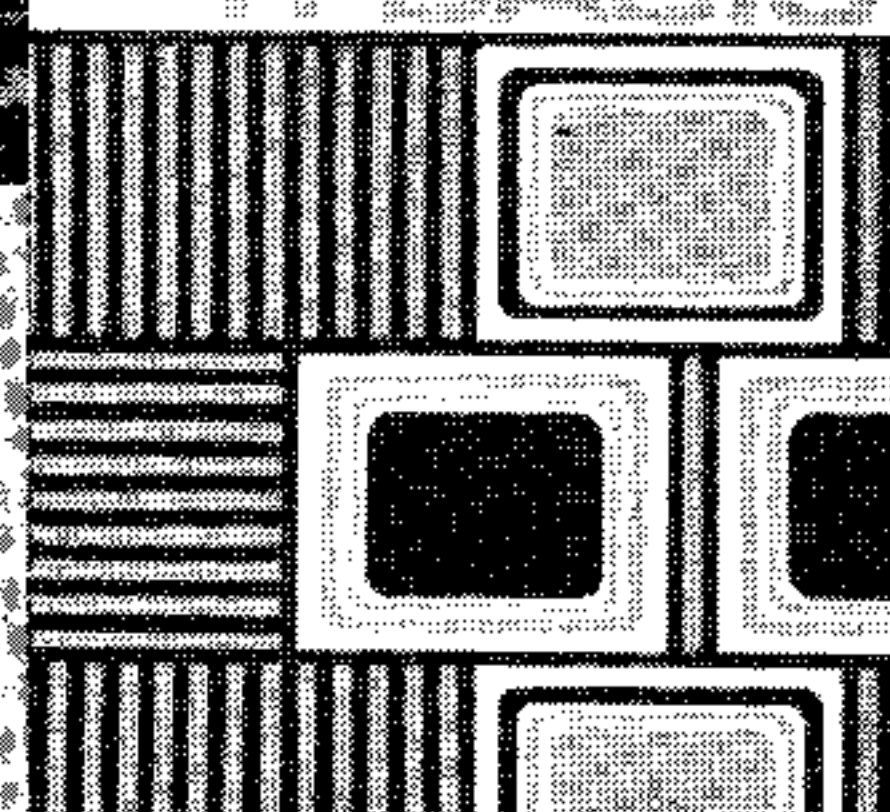
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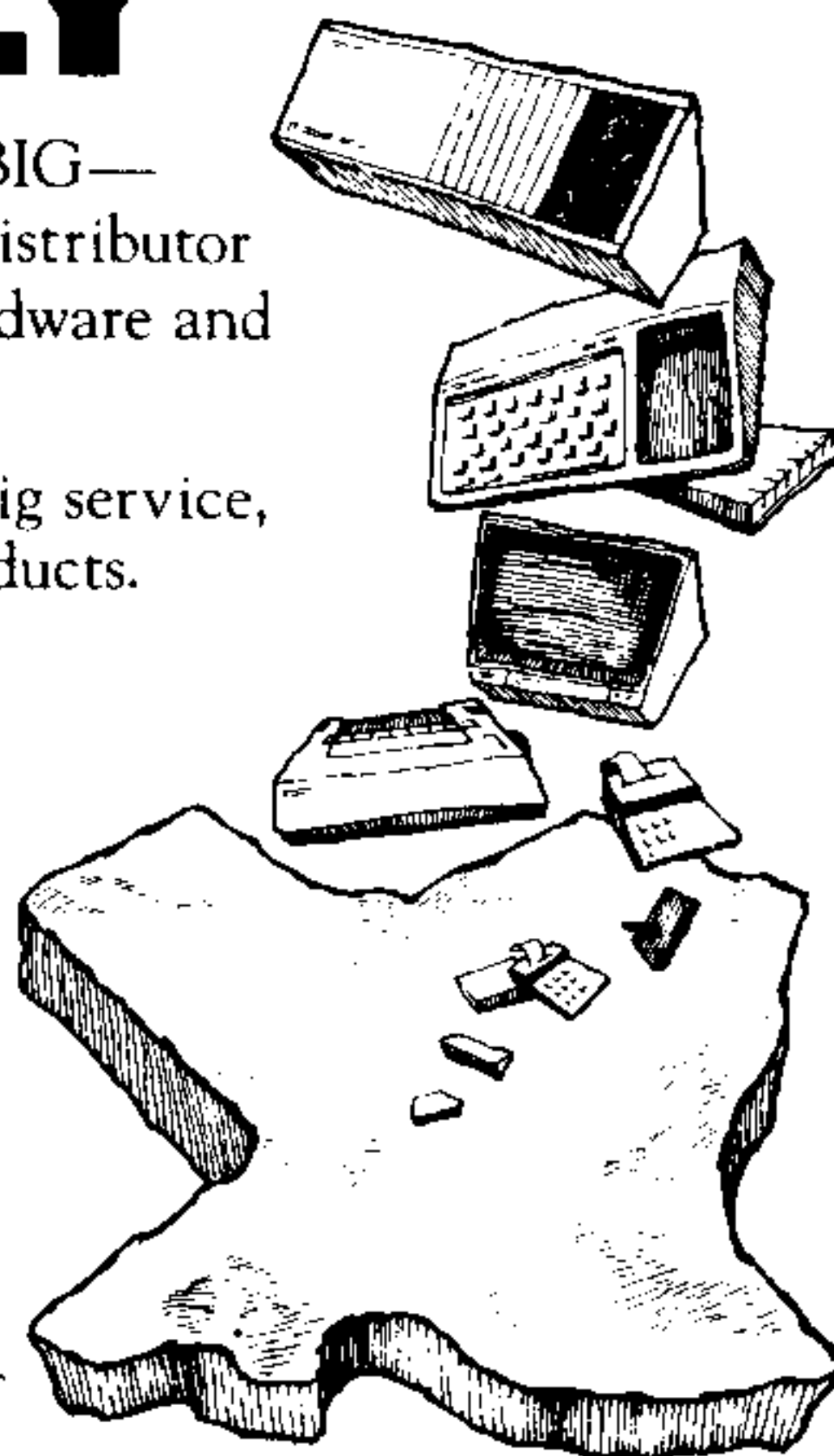
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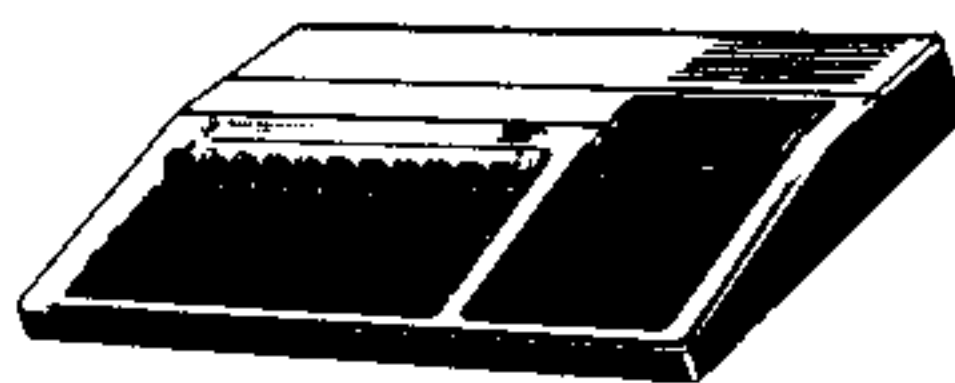
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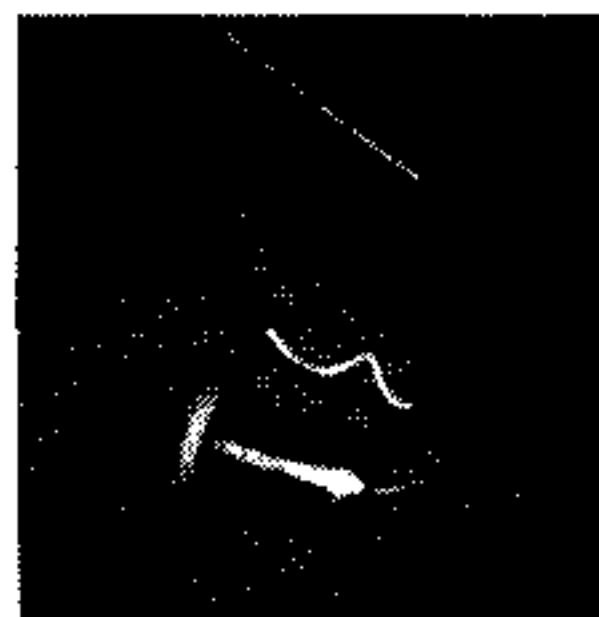
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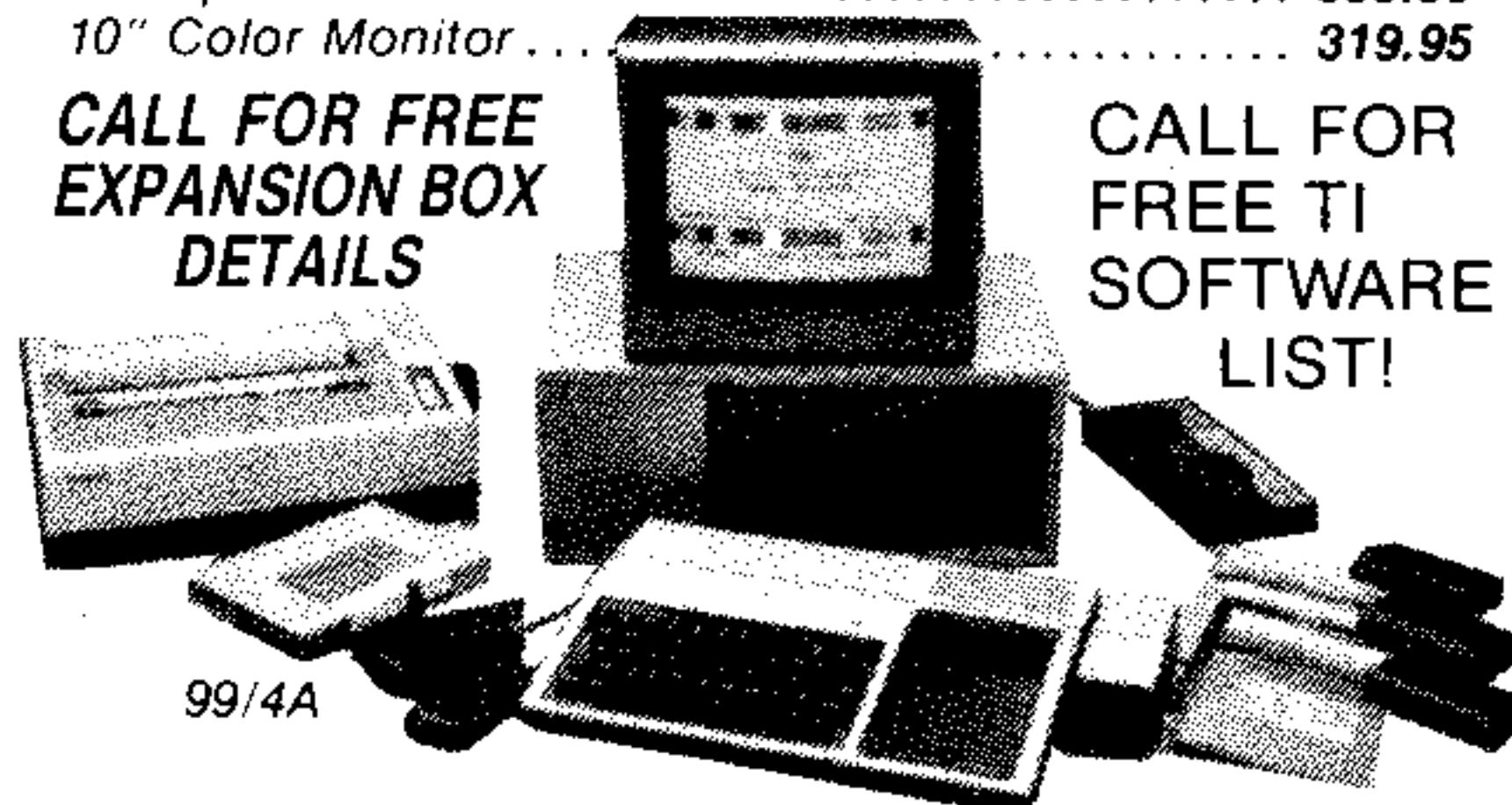
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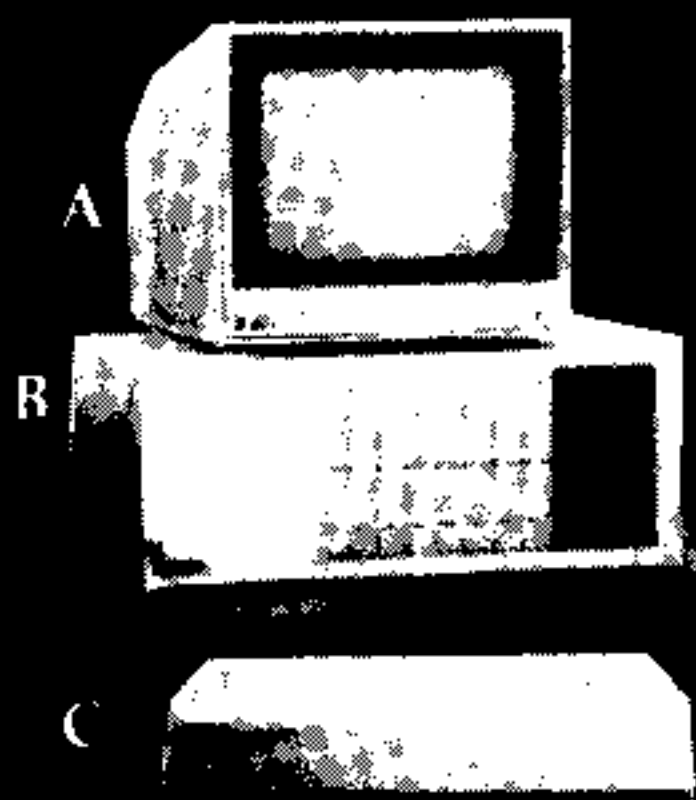
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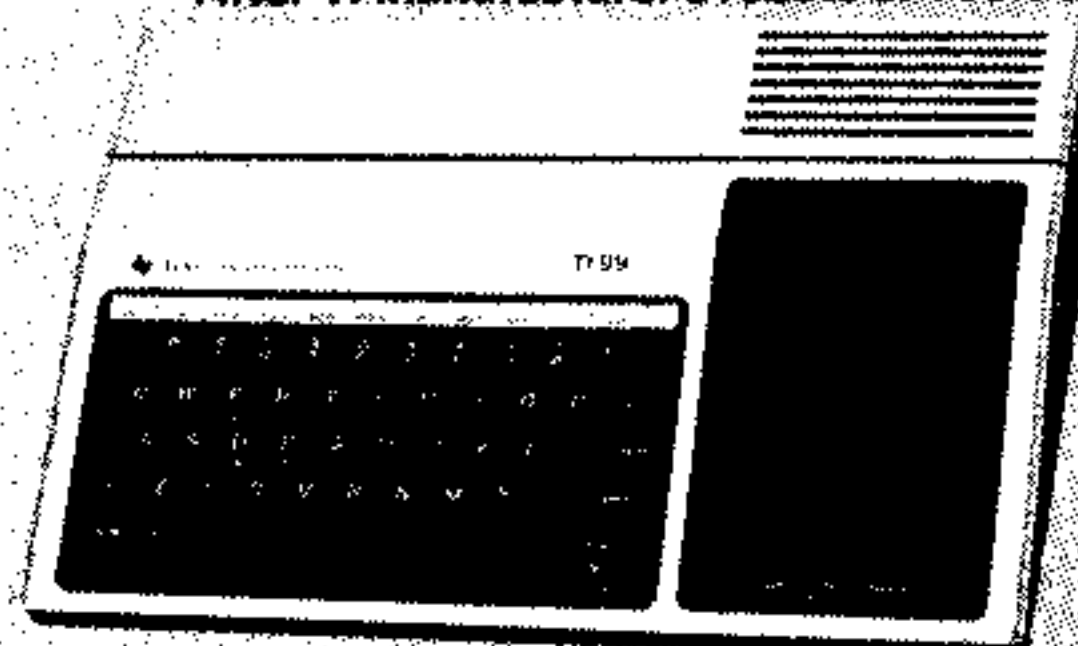
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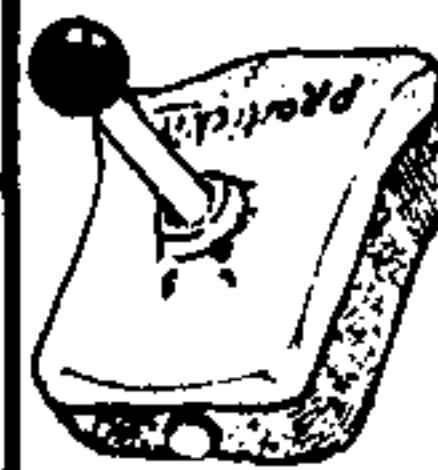
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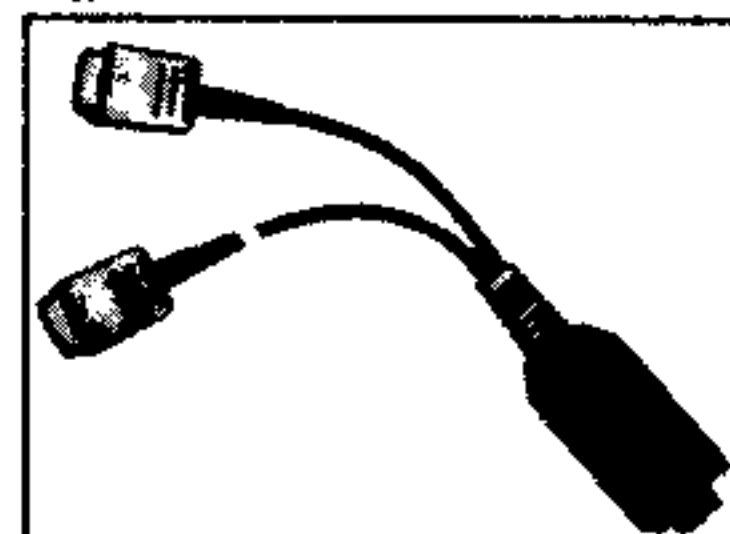
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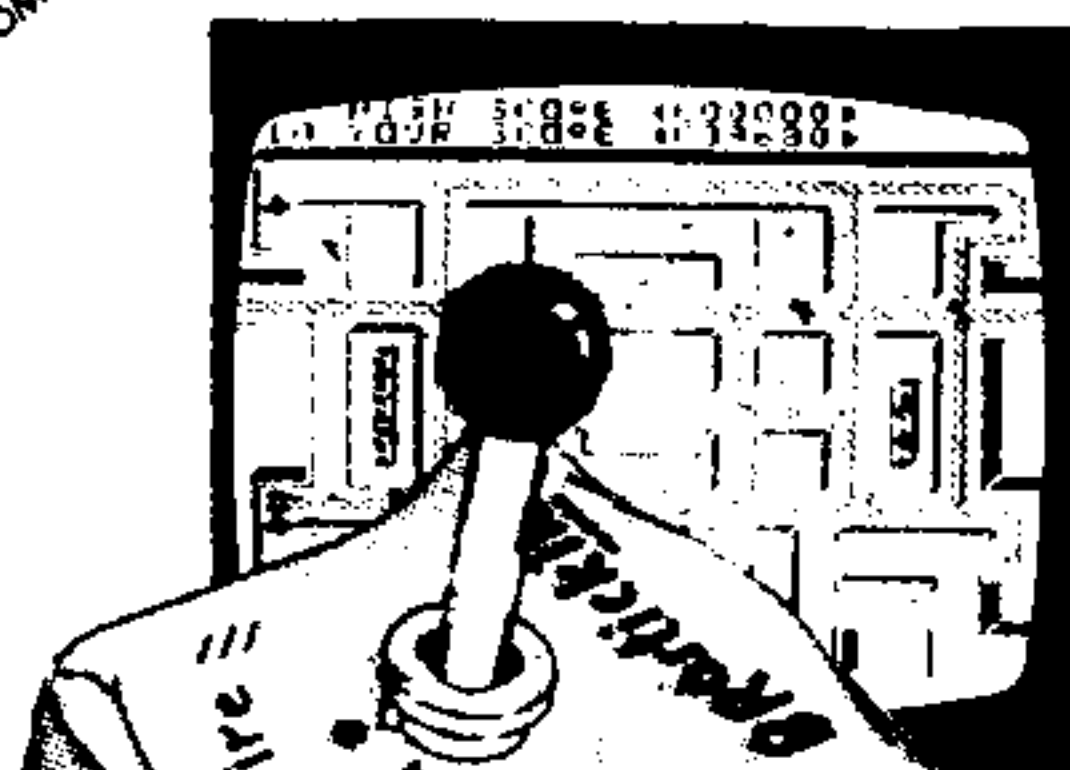


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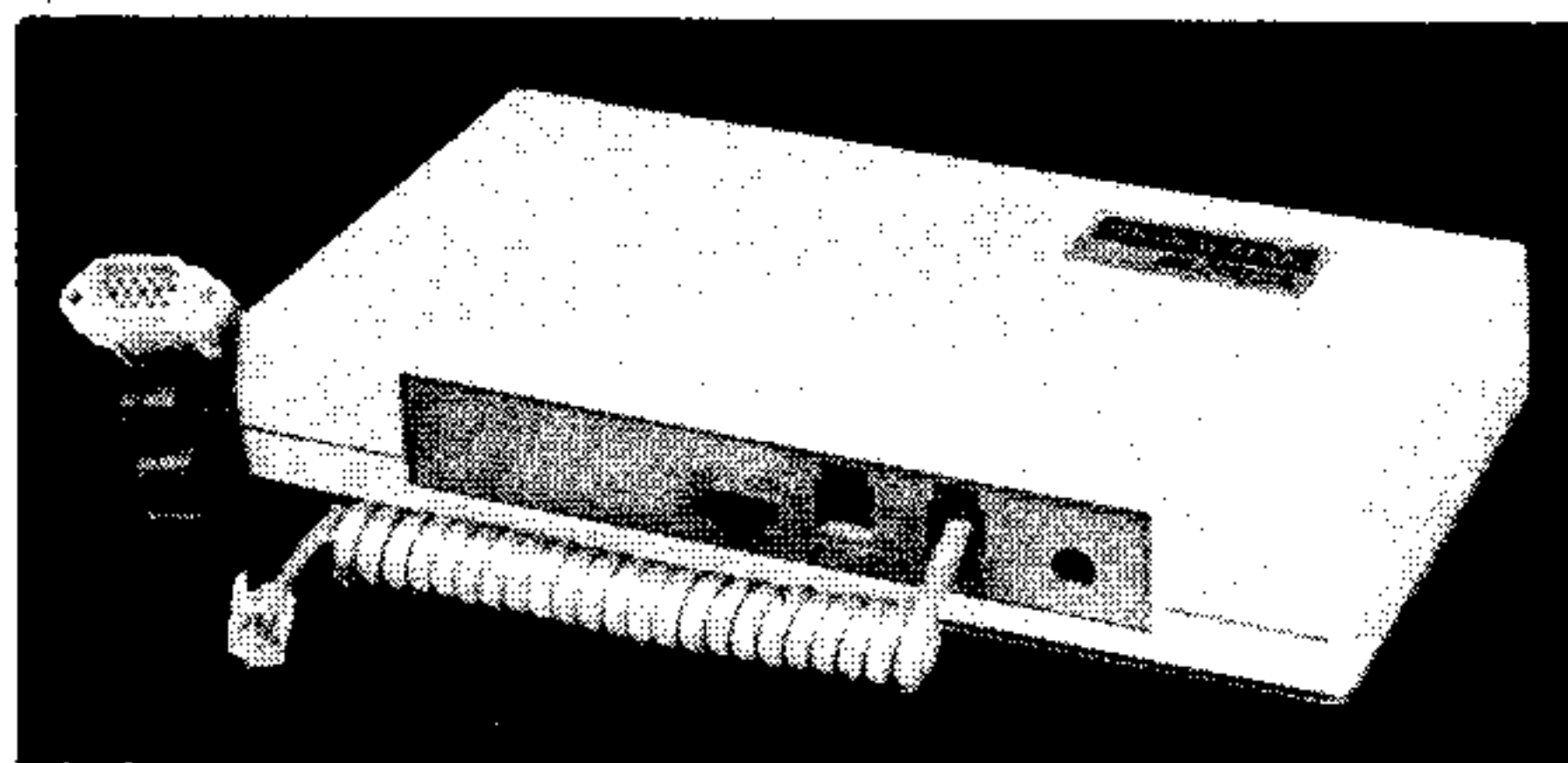
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Operate Mode: Manual dial, Automatic ANSW/ORIG selection
Data Rate: 0 to 300 bps, full duplex
Modulation: Frequency shift-keyed (FSK)
Line Interface: Direct-connect
Data Interface: TI RS-232C compatible, built-in cable to computer

Transmit Frequency	MARK	SPACE	ORIG	ANSW
	1270 Hz	1070 Hz	2225 Hz	2025 Hz

Transmit Frequency Accuracy: ± 0.01%

Transmit Level: -12 dBm typical
Receive Frequency: MARK 2225 Hz, SPACE 2025 Hz, ORIG 1270 Hz, ANSW 1070 Hz
Receive Frequency Tolerance: ± 0.5%
Carrier Detect Threshold: -44 dBm typical
Carrier Detect Indicator: Audible tone
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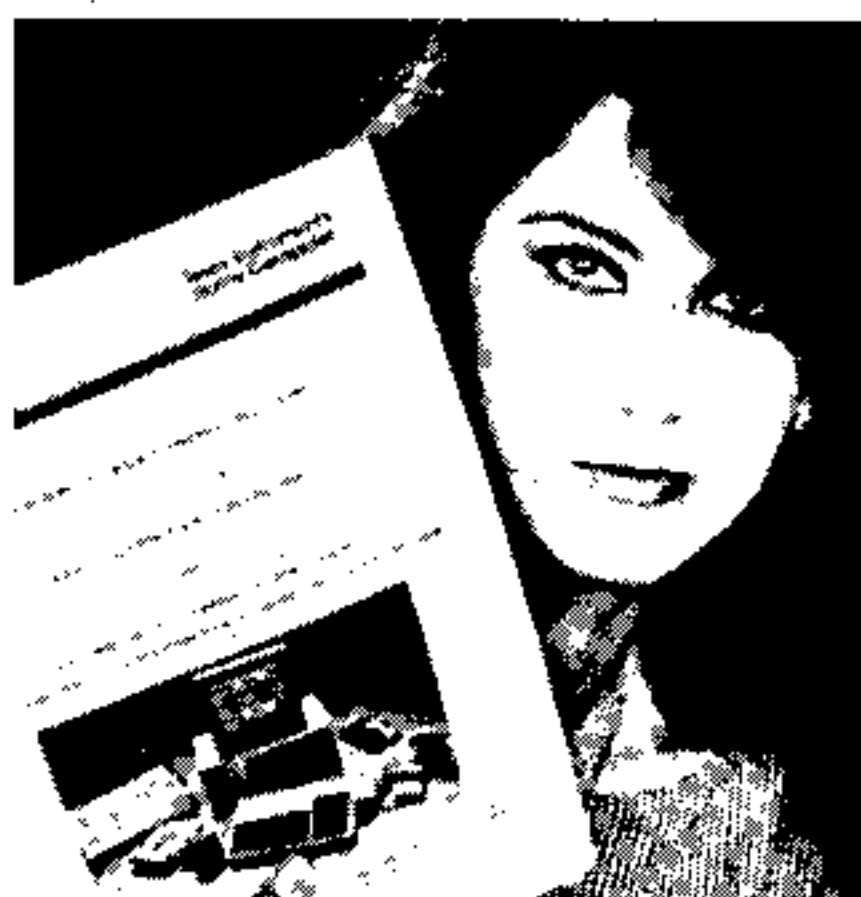
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Switch-a-Row ... from p. 27

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860 CALL HCHAR(4,15,113,3)
870 CALL VCHAR(5,16,113,3)
880 CALL HCHAR(8,15,113,3)
890 CALL HCHAR(4,19,113,3)
900 CALL VCHAR(5,20,113,4)
910 CALL HCHAR(4,24,113,2)
920 CALL HCHAR(4,23,136)
930 CALL VCHAR(5,23,113,3)
940 CALL HCHAR(8,23,139)
950 CALL HCHAR(8,24,113,2)
960 CALL VCHAR(4,27,113,5)
970 CALL HCHAR(6,28,113)
980 CALL VCHAR(4,29,113,5)
990 CALL HCHAR(12,13,113,2)
1000 CALL VCHAR(11,16,113,4)
1010 CALL HCHAR(10,16,136)
1020 CALL HCHAR(10,17,113)
1030 CALL HCHAR(10,18,137)
1040 CALL VCHAR(11,18,113,4)
1050 CALL HCHAR(12,17,113)
1060 CALL HCHAR(12,20,113,2)
1070 CALL VCHAR(16,11,113,5)
1080 CALL HCHAR(16,12,113)
1090 CALL HCHAR(16,13,137)
1100 CALL HCHAR(17,13,113)
1110 CALL HCHAR(18,13,138)
1120 CALL HCHAR(18,12,113)
1130 CALL HCHAR(19,13,137)
1140 CALL HCHAR(20,13,113)
1150 CALL HCHAR(16,15,136)
1160 CALL VCHAR(17,15,113,3)
1170 CALL HCHAR(20,15,139)
1180 CALL HCHAR(20,16,113)
1190 CALL HCHAR(20,17,138)
1200 CALL HCHAR(16,15,136)
1210 CALL HCHAR(16,16,113)
1220 CALL VCHAR(17,17,113,3)
1230 CALL HCHAR(16,17,137)
1240 CALL VCHAR(16,19,113,4)
1250 CALL HCHAR(20,19,139)
1260 CALL HCHAR(20,20,113)
1270 CALL HCHAR(19,20,136)
1280 CALL HCHAR(19,21,113)
1290 CALL HCHAR(19,22,137)
1300 CALL HCHAR(20,22,113)
1310 CALL HCHAR(20,23,138)
1320 CALL VCHAR(16,23,113,4)
1330 FOR I=1 TO 3
1340 CALL HCHAR(12,5,120,7)
1350 CALL HCHAR(12,23,121,7)
1360 FOR DELAY=1 TO 100
1370 NEXT DELAY
1380 CALL HCHAR(12,5,121,7)
1390 CALL HCHAR(12,23,120,7)
1400 FOR DELAY=1 TO 100
1410 NEXT DELAY
1420 NEXT I
1430 RETURN
    
```

```

1440 DATA 2,10,SWITCH-A-ROW,4,8,16
      SMALL SQUARES ARE,5,4,"ARRANGE
      D 4 BY 4, IN ROWS,"
1450 DATA 6,4,BY COLORS.,8,8,"AT TH
      E START, ROW",9,4,COLORS ARE:,
      11,13,YELLOW
1460 DATA 12,13,RED,13,13,BLUE,14,1
      3,GREEN,16,8,THE OBJECT OF THE
      ,17,4,GAME IS TO SWITCH THE RO
      WS
1470 DATA 18,4,TO REVERSE ORDER:,20
      ,13,GREEN,21,13,BLUE,22,13,RED
      ,23,13,YELLOW,24,5,**TYPE 1 TO
      CONTINUE**
1480 DATA 2,10,SWITCH-A-ROW,4,8,ONE
      PLACE IN THE,5,4,YELLOW ROW I
      S BLACK - MOVE,6,4,A SQUARE AD
      JACENT TO THE
1490 DATA 7,4,BLACK SPACE INTO THAT
      SPOT,8,4,BY ENTERING THE ROW
      AND,9,4,COLUMN OF THE SQUARE Y
      OU
1500 DATA 10,4,WANT TO MOVE.,12,8,"
      FOR EXAMPLE, A3 MOVES",13,4,TH
      E COLORED SQUARE FROM A3
1510 DATA 14,4,"INTO THE BLACK SPAC
      E, AND",15,4,THE BLACK SPACE I
      S NOW IN,16,4,A3. REARRANGE TH
      E COLORED
1520 DATA 17,4,SQUARES UNTIL YOU WI
      N!,19,5,***TYPE 1 TO PLAY***
1530 RESTORE 1440
1540 FOR I=1 TO 18
1550 READ X,Y,D#
1560 GOSUB 2490
1570 NEXT I
1580 CALL HCHAR(11,22,112,4)
1590 CALL HCHAR(12,22,113,4)
1600 CALL HCHAR(13,22,120,4)
1610 CALL HCHAR(14,22,121,4)
1620 CALL HCHAR(20,22,120,4)
1630 CALL HCHAR(21,22,120,4)
1640 CALL HCHAR(22,22,113,4)
1650 CALL HCHAR(23,22,112,4)
1660 CALL KEY(0,K,ST)
1670 IF ST=0 THEN 1660
1680 IF K<>49 THEN 1670
1690 CALL CLEAR
1700 FOR I=1 TO 15
1710 READ X,Y,D#
1720 GOSUB 2490
1730 NEXT I
1740 CALL KEY(0,K,ST)
1750 IF ST=0 THEN 1740
1760 IF K<>49 THEN 1740
1770 CALL CLEAR
1780 RESTORE 570
1790 READ X,Y,D#
1800 GOSUB 2490
1810 FOR I=4 TO 6
1820 CALL HCHAR(1,9,112,11)
    
```


ROBANS

WHERE IS THAT ROBANS HIDING? THERE HE IS... HE HAS MOVED OUT INTO THE OPEN. THOSE ROCKS ARE NO TROUBLE FOR HIM. LOOK AT HIM THROW THEM AROUND THE **MAGIC MUSHROOMS** I'M AFTER ARE ALL OVER THIS PLANET... BUT I GOT TO EVADE THAT **GALACTIC ROBOT COP**. IF I CAN CLEAN UP THIS AREA, I CAN MOVE ON TO MORE **CHALLENGING FIELDS**. MAYBE IF I CAN LURE HIM OVER HERE... AND THEN SNEAK BACK THIS WAY... I DID IT... BOY IS HE MAD **JUST LOOK AT HIM COME**.

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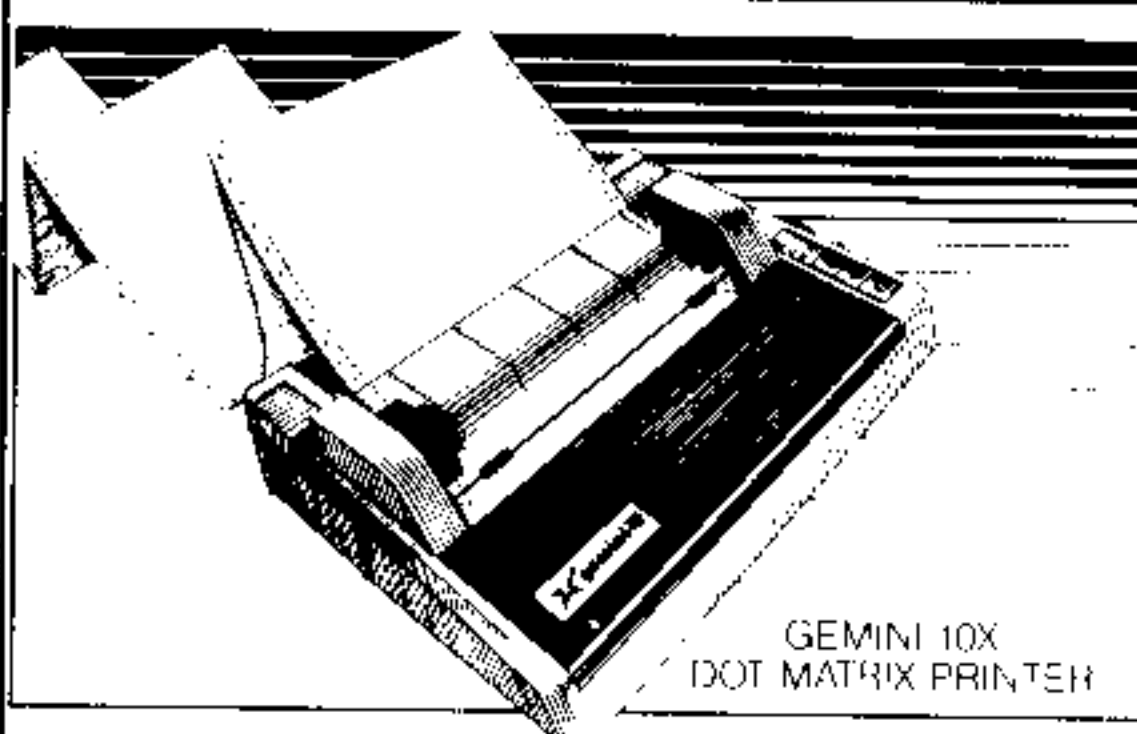
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```
1838 NEXT I
1848 FOR I=4 TO 6
1858 CALL HCHAR(I,21,128,3)
1868 NEXT I
1878 FOR J=8 TO 16 STEP 4
1888 READ N
1898 FOR I=1 TO 3
1908 CALL HCHAR(J+I-1,9,N,15)
1918 NEXT I
1928 NEXT J
1938 FOR J=12 TO 24 STEP 4
1948 CALL VCHAR(4,J,129,15)
1958 NEXT J
1968 R=65
1978 S=52
1988 MOVE=0
1998 N=49
2008 FOR J=9 TO 21 STEP 4
2018 CALL HCHAR(3,J,N)
2028 N=N+1
2038 NEXT J
2048 N=65
2058 FOR J=4 TO 16 STEP 4
2068 CALL HCHAR(J,8,N)
2078 N=N+1
2088 NEXT J
2098 FOR I=1 TO 2
2108 READ X,Y,D#
2118 GOSUB 2490
2128 NEXT I
2138 CALL SOUND(100,294,2)
2148 CALL KEY(0,A,ST)
2158 IF ST=0 THEN 2140
2168 IF A=81 THEN 2920
2178 IF (A<65)+(A>68) THEN 2800
2188 CALL KEY(0,DU,ST)
2198 IF ST=-1 THEN 2180
2208 CALL KEY(0,B,ST)
2218 IF ST=0 THEN 2200
2228 IF B=81 THEN 2920
2238 IF (B<49)+(B>52) THEN 2800
2248 IF A=R THEN 2280
2258 IF B<>S THEN 2800
2268 IF (ABS(A-R)<>1) THEN 2800
2278 GOTO 2290
2288 IF (ABS(B-S)<>1) THEN 2800
2298 C=(R-64)*4
2308 D=(S-48)*4+5
2318 R=A
2328 S=B
2338 A=(A-64)*4
2348 B=(B-48)*4+5
2358 CALL GCHAR(A,B,CH)
2368 FOR I=A TO A+2
2378 CALL HCHAR(I,B,128,3)
2388 NEXT I
2398 FOR I=C TO C+2
2408 CALL HCHAR(I,D,CH,3)
2418 NEXT I
2428 GOSUB 2530
2438 MOVE=MOVE+1
2448 D#=STR$(MOVE)
```

```
2450 X=21
2460 Y=19
2470 GOSUB 2490
2480 GOTO 2130
2490 FOR J=1 TO LEN(D#)
2500 CALL HCHAR(X,Y+J,ASC(SEG$(D#,J),1))
2510 NEXT J
2520 RETURN
2530 RESTORE 650
2540 FOR J=4 TO 12 STEP 4
2550 READ N
2560 FOR I=9 TO 21 STEP 4
2570 CALL GCHAR(J,I,CH)
2580 IF CH<>N THEN 2620
2590 NEXT I
2600 NEXT J
2610 GOTO 2630
2620 RETURN
2630 RESTORE 610
2640 G=2^(1/12)
2650 FOR P=1 TO 13
2660 CALL SOUND(100,110*G^P,0)
2670 NEXT P
2680 READ X,Y,D#
2690 GOSUB 2490
2700 FOR DELAY=1 TO 500
2710 NEXT DELAY
2720 RESTORE 620
2730 READ X,Y,D#
2740 GOSUB 2490
2750 CALL KEY(0,K,ST)
2760 IF ST=0 THEN 2750
2770 IF K=81 THEN 2920
2780 IF K=49 THEN 1770
2790 GOTO 2720
2800 CALL SOUND(100,131,3)
2810 CALL SOUND(200,131,2)
2820 RESTORE 630
2830 FOR I=1 TO 2
2840 READ X,Y,D#
2850 GOSUB 2490
2860 NEXT I
2870 FOR DELAY=1 TO 50
2880 NEXT DELAY
2890 CALL HCHAR(20,26,32,4)
2900 CALL HCHAR(21,25,32,6)
2910 GOTO 2130
2920 CALL CLEAR
2930 RESTORE 640
2940 FOR I=1 TO 3
2950 READ X,Y,D#
2960 GOSUB 2490
2970 NEXT I
2980 CALL KEY(0,K,ST)
2990 IF ST=0 THEN 2980
3000 IF K=78 THEN 3050
3010 IF K=89 THEN 3030
3020 GOTO 2980
3030 CALL CLEAR
3040 GOTO 340
3050 END
```


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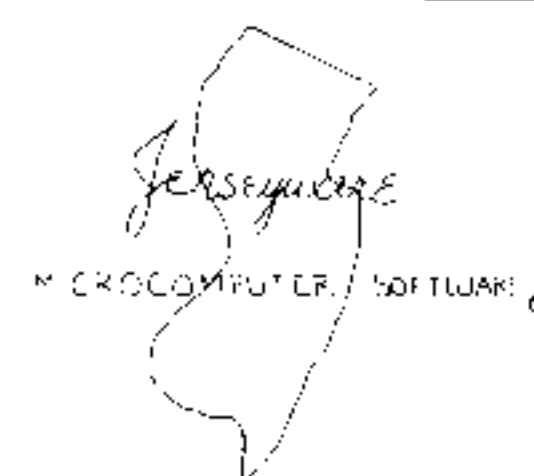
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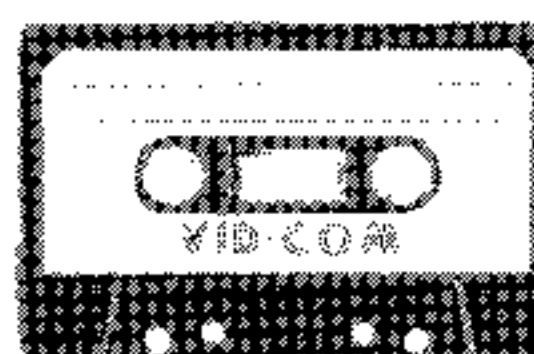
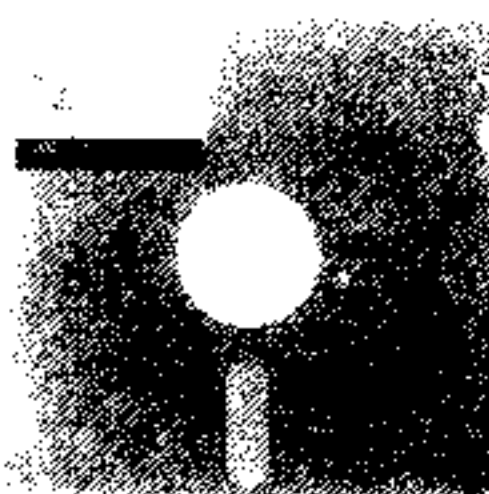
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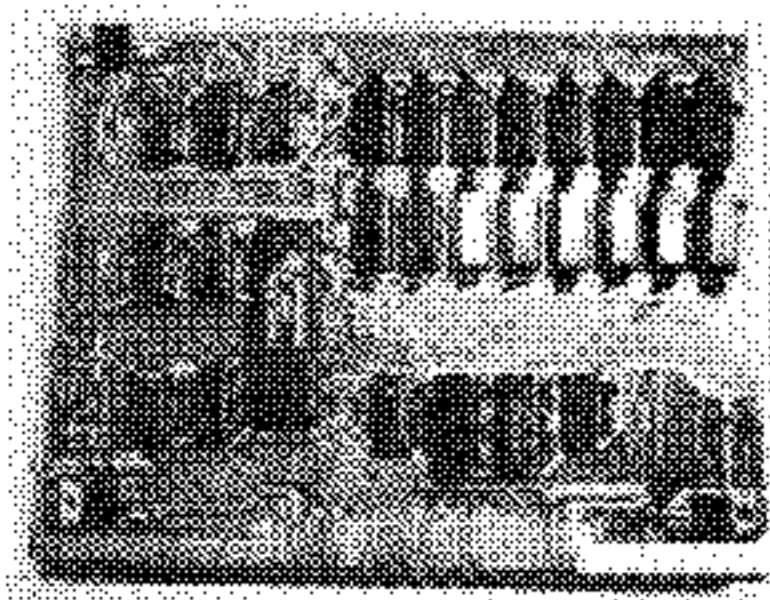
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Treasure Island... from p. 26

```
220 PRINT "GAME BEFORE THE PIRATE"
230 PRINT "CAPTURES YOU! (TOUCHES YOU)"
240 PRINT
250 PRINT "(W)—DISPLAYS WEALTH & D
260 PRINT "PTION": "TO BARGAIN WITH THE PI
270 PRINT "RATE.": "BARGAIN WELL & THE PIR
280 PRINT "ATE": "GOES HOME."
290 PRINT
300 PRINT "(R)—REVEALS PACES &": "D
310 PRINT "IRECTION TO FIND TREASURE."
320 PRINT
330 PRINT "NOTE: IF THE SNAKE IS O
340 PRINT "N THE": "TREASURE: YOU MUST REV
350 PRINT "EAL TO MAKE THE SNAKE DISAPPEA
360 PRINT "R*!"
370 PRINT
380 PRINT "ARROW KEYS MOVE YOUR MA
390 PRINT "N."
400 PRINT
410 PRINT "PRESS <ENTER> TO START."
420 PRINT
430 PRINT
440 ACCEPT AT(23,10):S* :: IF S*="
450 S" THEN 340
```

```
340 CALL CLEAR :: RANDOMIZE :: CAL
350 L MAGNIFY(3)
360 DISPLAY AT(10,8): "TREASURE ISL
370 AND" :: DISPLAY AT(12,8): "BY
380 G. J. SMITH"
390 DISPLAY AT(19,1): "LEVEL 1-EXPE
400 RT": "LEVEL 2-MEDIUM": "LEVEL 3-
410 BEGINNER": "SELECT 1 OR 2 OR 3"
420 ACCEPT AT(22,20):VALIDATE(DIGIT
430 )BEEP:LEV :: L=LEV*4
440 CALL SCREEN(5)
450 CALL CHAR(33,"FFFFFFF55000000
460 000000000000000000000000000000
470 000000000000000000000000000000
480 000000000000000000000000000000
490 000000000000000000000000000000
500 000000000000000000000000000000
510 000000000000000000000000000000
520 000000000000000000000000000000
530 000000000000000000000000000000
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960 000000000000000000000000000000
970 000000000000000000000000000000
980 000000000000000000000000000000
990 000000000000000000000000000000
1000 000000000000000000000000000000
```

```
430 DATA 250,880,587,370,250,880,5
440 DATA 250,740,587,440,250,880,5
450 DATA 700,988,622,500,400,784,6
460 DISPLAY AT(2,20): "LAND HQ"
470 DEF PACE=INT(SQR(SP1)/6)+INT(S
480 DEF TD=INT(PACE/4+1)
490 FOR DA=1 TO 11 :: READ CA,CA*
500 :: CALL CHAR(CA,CA*): NEXT DA
510 :: GOTO 1340
520 DATA 81,183C42C3C3423C18,109,8
530 DATA 112,7FFFFFFF40FFB0A0DFFFFFFF
540 DATA 104,070F0F070F7FFF9F1F1F1
550 DATA 132,0303011F1717070706040
560 DATA 136,070F0F070F7FFF9F1F1F1
570 REM MAIN LOOP
580 GO SUB 780
590 GOSUB 870
600 CALL POSITION(#1,SX,SY,#2,VX,W
610 Y,#6,SNX,SNY):: CALL PATTERN(#
620 1,132,#2,136)
630 CALL MOTION(#2,0,0)
640 CALL COINC(#1,#4,10,BD):: CALL
650 COINC(#1,#2,10,BB)
660 IF BD THEN 1560 ELSE IF BB THE
670 N 1730
680 CALL KEY(1,K1,S1):: IF (K1<0)+
690 (K1>6) THEN 640
700 CALL SOUND(10,440,2)
710 ON K1+1 GOSUB 740,640,750,760,
720 1080,770,840
730 IF REV<L THEN 720
740 IF VX>SX THEN CALL MOTION(#2,-
750 18,0)
760 IF WY>SY THEN CALL MOTION(#2,0
770 ,-14)
780 IF WY<SY THEN CALL MOTION(#2,0
790 ,14)
800 CALL PATTERN(#2,104):: CALL SO
810 UND(50,-3,2)
820 IF SX<11 THEN GOSUB 740 ELSE I
830 F SY>240 THEN GOSUB 750 ELSE I
840 F SY<20 THEN GOSUB 760 ELSE IF
850 SX>180 THEN GOSUB 770
860 GOTO 600
870 CALL LOCATE(#1,SX+6,SY):: CALL
880 PATTERN(#1,128):: RETURN
890 CALL LOCATE(#1,SX,SY-6):: CALL
900 PATTERN(#1,128):: RETURN
910 CALL LOCATE(#1,SX,SY+6):: CALL
920 PATTERN(#1,128):: RETURN
930 CALL LOCATE(#1,SX-6,SY):: CALL
940 PATTERN(#1,128):: RETURN
950 REM RANDOM TREASURE
960 RANDOMIZE
970 TRX=INT(RND*130)+27
980 TRY=INT(RND*200)+33
990 CALL LOCATE(#3,TRX,TRY,#6,TRX,
1000 TRY):: CALL COLOR(#6,1):: RETU
1010 RN
1020 REM TREASURE DISTANCE
1030 REV=REV+1 :: CALL COINC(#1,#3,
1040 8,T):: IF T THEN 960
1050 SNAK=1 :: SNA=INT(3*RND)+1 ::
1060 DISPLAY AT(1,8): ""
1070 IF SNA=2 AND L<9 THEN DISPLAY
1080 AT(1,8): "SNAKE" ELSE SNAK=
1090 0
1100 CALL POSITION(#1,SX,SY,#3,TRX,
1110 TRY)
1120 CALL DISTANCE(#1,SX,TRY,SP1)::
1130 CALL DISTANCE(#3,SX,TRY,TRE)
```

Continued on p. 51

TI-99/4A * SCHEMATICS * HARDWARE * SOFTWARE

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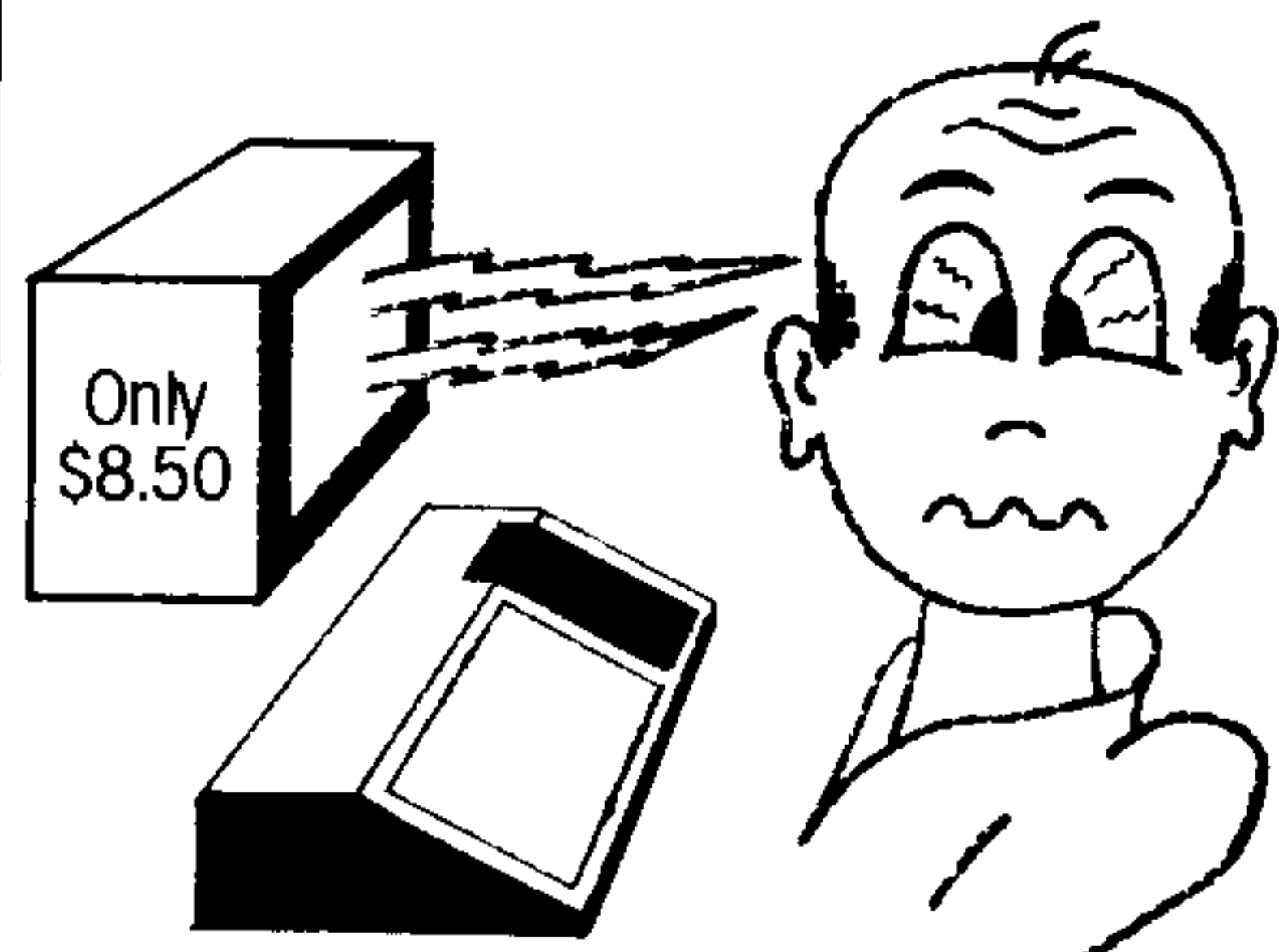
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Treasure Island ... from p. 49

```
890 DISPLAY AT(24,8):PAGE;"PAGES"
900 IF TRX<SX AND TRY>SY THEN DISP
    LAY AT(24,18):"NE"
910 IF TRX>SX AND TRY<SY THEN DISP
    LAY AT(24,18):"SW"
920 IF TRX<SX AND TRY<SY THEN DISP
    LAY AT(24,18):"NW"
930 IF TRX>SX AND TRY>SY THEN DISP
    LAY AT(24,18):"SE"
940 RETURN
950 REM TREASURE FOUND
960 IF SNAKE=0 THEN 980 ELSE CALL C
    OLOR(16,2)
970 CALL COINC(1,16,10,SNAKE):: I
    F SNAKE THEN 1750
980 CALL COLOR(13,2):: FOR CD=1 TO
    3
990 AB=INT(RND*3)+1
```

```
1000 ON AB GOSUB 1040,1050,1060
1010 FOR SO=165 TO 587 STEP 72 :: C
    ALL SOUND(-1000,SO,9):: NEXT S
    O
1020 DISPLAY AT(24,8):"" :: NEXT CO
    :: CALL COLOR(13,1)
1030 FOR DE=1 TO 70 :: NEXT DE :: G
    OTO 800
1040 A=A+TD :: DISPLAY AT(24,8):A$
    :: RETURN
1050 B=B+TD :: DISPLAY AT(24,8):B$
    :: RETURN
1060 C=C+TD :: DISPLAY AT(24,8):C$
    :: RETURN
1070 REM BARGAIN
1080 CALL CLEAR :: CALL COLOR(14,1,
    15,1):: TI=0
1090 FOR PA=1 TO 3 :: PB=INT(RND*3)
    +1
```

```
1100 ON PB GOSUB 1110,1120,1130 ::
    NEXT PA :: GOTO 1140
1110 D=D+INT(6*RND+1):: RETURN
1120 E=E+INT(3*RND+1):: RETURN
1130 F=F+INT(3*RND+1):: RETURN
1140 CALL LOCATE(1,70,200,1,90,19
    0):: CALL MAGNIFY(4)
1150 DISPLAY AT(2,1)ERASE ALL:A$:A:
    B$:B:C$:C :: AC=0
1160 DISPLAY AT(22,8):"BARGAIN?(Y/N
    ) Y"
1170 ACCEPT AT(22,22)VALIDATE("YN")
    SIZE(-1)BEEP:YN$
1180 IF YN$="Y" THEN 1190 ELSE 1300
1190 ON AC+1 GOTO 1270,1280,1290,11
    50
1200 DISPLAY AT(AA,1):CC$:DD$
1210 ACCEPT AT(AA,16)VALIDATE(DIGIT
    )BEEP:RA
1220 IF RA>P OR RA=0 THEN 1250 ELSE
    IF RA>=Q THEN 1310
1230 CALL PATTERN(102,104)
1240 AC=AC+1 :: DISPLAY AT(11,22):"
    NO" :: GOTO 1260
1250 AC=AC+1 :: IF AC=3 THEN 1140 ::
    : DISPLAY AT(BB,1):"TRY AGAIN,
    BUSTER"
1260 FOR DE=1 TO 30 :: NEXT DE :: C
    ALL PATTERN(102,136):: CALL SOU
    ND(100,-5,2):: GOTO 1190
1270 C1=1 :: P=A :: Q=D :: AA=6 ::
    BB=8 :: DD=A$ :: GOTO 1200
1280 C1=2 :: P=B :: Q=E :: AA=10 ::
    BB=12 :: DD=B$ :: GOTO 1200
1290 C1=3 :: P=C :: Q=F :: AA=14 ::
    BB=16 :: DD=C$ :: GOTO 1200
1300 CALL CLEAR :: TI=1 :: GOTO 139
    0
1310 DISPLAY AT(11,22):"YES" :: FOR
    DE=1 TO 50 :: NEXT DE
1320 IF C1=1 THEN A=P-RA ELSE IF C1
    =2 THEN B=P-RA ELSE IF C1=3 TH
    EN C=P-RA
1330 CALL CLEAR :: REV=0 :: TI=2 ::
    GOTO 1390
1340 CALL CLEAR :: A=0 :: B=0 :: C=
    0
1350 D=0 :: E=0 :: F=0 :: REV=0 ::
    TI=0 :: SNAK=0
1360 A$="BOTTLES OF RUM" :: B$="STR
    INGS OF PEARLS"
1370 C$="GOLD DOUBLOONS" :: CC$="WI
    LL YOU TAKE?"
1380 CALL SPRITE(102,136,1,237,237,1
    3,112,1,100,170,16,140,1,88,16
    6)
1390 FOR CD=9 TO 11 :: CALL COLOR(C
    D,1,1):: NEXT CD :: CALL VCHAR
    (1,1,100,119)
1400 RESTORE 1410 :: FOR TREE=1 TO
    16 :: READ HA,HB,HC :: CALL HC
    HAR(HA,HB,HC):: NEXT TREE
1410 DATA 3,22,108,5,19,108,7,21,10
    8,10,24,108,17,25,108,4,22,109
    ,6,19,109,8,21,109,11,24,109,1
    8,25,109
1420 DATA 3,28,81,2,28,78,3,27,87,4
    ,28,83,3,29,69,24,5,101
1430 FOR BUSH=1 TO 17 :: READ BU1,B
    U2 :: CALL HCHAR(BU1,BU2,110):
    : NEXT BUSH
1440 DATA 5,31,7,30,8,28,9,31,11,29
    ,12,28,13,30,15,27,15,31
1450 DATA 16,29,18,29,19,31,20,28,2
    1,27,22,29,22,31,23,30,1,1
1460 CALL COLOR(9,5,1,10,13,1,11,2,
    1):: CALL MAGNIFY(3)
1470 ON TI+1 GOTO 1480,1520,1540
1480 CALL SCREEN(11):: FOR DE=1 TO
    120 :: NEXT DE :: CALL MOTION(
    14,0,0,15,0,0)
1490 FOR DE=1 TO 140 :: NEXT DE ::
    CALL MOTION(1,0,0)
1500 CALL LOCATE(1,26,48,1,237,23
    7,14,20,19,15,28,19):: CALL CO
    LOR(1,7,12,2,14,16,15,2)
1510 GOTO 580
1520 CALL COLOR(14,16,15,2):: CALL
    LOCATE(1,5X,SY,1,2,1X,WY):: RE
    TURN
1530 REM PIRATE RELOCATE
```

Continued on p. 60



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WAR GAMES

THE MOVIE AND THE BOOK

REVIEW

By Erin O'Connor

99'er HCM Staff

Our innocent focus on kids and computers in last month's 99'er HCM didn't quite prepare us for United Artists' new movie, *WarGames*. The movie is about kids and computers run amok—a logical extension, or absurd expansion, of computer gaming that takes us from a home-computer console to the war room of the North American Air Defense Command (NORAD). It is a humorous examination of sobering possibilities, and if it carries its weighty matter lightly, it can well afford to because its conclusions are inescapable.

If you privately applauded the ingenuity of teen-aged "blue boxers" who toyed with Ma Bell in the seventies, you'll want to encourage David Lightman, the likable computer-buff hero of *WarGames*. Though he's failing Biology at Seattle's Snohomish High School, David is an electronics whiz who can impose his will on the telephone company, his high school's electronic grade book, or a computerized lock. At home in his room David busies himself at his computer console. He starts out small, using his modem to patch in to his school's computer to change that failing grade. But an ad for a new line of computer games inspires David to some home computer larceny. He sets his console and modem to work on a random search to LOGON to the software house's computer. When he logs on to a computer that won't let him in, he's convinced he's found the new line of games. Sure enough, when he keys in LIST GAMES, the computer obliges with what seems like a standard game menu that progresses from the innocuous to the apocalyptic. The repertoire of options seems predictable enough—Falken's Maze, Blackjack, Checkers, Chess, Bridge, Fighter Combat, Theatre-wide Biotoxic and Tactical Warfare, Global Thermonuclear War. After some research that leads David and his girlfriend Jennifer to intuit the computer's "backdoor" password ("Joshua"), David is "in" to what promises to be the most sophisticated computer game of his career. Excited by the prospect of Global Thermonuclear War, David impulsively opts to play for the Russians, and with happy abandon he and Jennifer immediately nuke Las Vegas and Seattle.

The WOPR (War Operation Plan Response) computer at NORAD's underground Command Center is only too happy to oblige David with a good game of Global Thermonuclear War. Its *raison d'être* is to simulate World War III, estimate responses and damage, and count the dead. When a thoroughly frightened David tries to break off mid-game, WOPR pursues the game as we've been taught to believe a computer should, disinterestedly and relentlessly.

The movie *WarGames* stresses the drama inherent in the idea of imminent thermonuclear confrontation and in the comic and dangerous inability of both men and machines to distinguish between games and reality. David Bischoff's book adaptation of the screenplay (*WarGames*, Dell Publishing Co., Inc., New York, 1983) serves as a gloss of the movie but is also able to take advantage of the more leisurely print medium to focus on the relationship between men and their machines. The computer is assumed to belong to the family of man; we are not so much warned of the danger of anthropomorphizing our computers, as we are cautioned to figure out whether they are our children or our fathers. Though he is *not* sure how we should employ our notions of relatedness to the computer, Dr. Falken (WOPR/Joshua's Prime Programmer) *does* understand that the relationship is a complex and paradoxical one. He reminds the young people, "The computer, my dears, was not built as the result of an urgent desire of mankind to see a little yellow ball gobbling up dots in a maze. The computer is, in a very real sense, the child of war—



and as Wordsworth says, the child is the father of the man." The WOPR is both the child Joshua and the heroic prophet Joshua who leads the nation in war. This child-father paradox underlies the complex relationship between men and their computer progeny/leaders. The general, our human Joshua, is slavishly dependent on the computer's information and instructions; David, the child, is the one who realizes that Joshua must learn as a child would. In the midst of the game, with only hours to go before it launches a full-scale retaliatory attack on Russia, the computer is asked, "Is this a game, or is it real?" With that innocent literalness of computers, Joshua answers, WHAT'S THE DIFFERENCE? And of course it doesn't recognize a difference any more than do the generals and strategists—who, childishly led by Joshua's logic, respond to a simulated and wholly unverified Russian attack with a real counter-attack. Both the computer and the generals must learn the concept of futility, i.e., when it is time to give up.

Neatly enough, it is the light-bearing child, David, who seizes on a similarity between humans and the computer to teach Joshua that there are times when THE ONLY WINNING MOVE IS NOT TO PLAY. This message seems to be the

primary focus of the movie, whereas the book is more interested in our obligation to teach our progeny and thus focuses on how the computer can learn. Joshua's special feature is its integration program, a holistic system like our own brains, whereby learning in one area can be generalized to others. Therefore, the learning that goes on in a lowly game of *Tic Tac Toe* that nobody can possibly win gets extended to the deadly war game in time to save the day.

We found the difference between the book and the movie to be something like that between the first generation of adventure games, which relied wholly on text and the player's imagination for complexity and effect, and the next generation with its new graphics that somehow fell short of the human imagination. Although it boasts a "Production Designer," the movie does not seem particularly spectacular or high tech, and the descriptions of action in the book seem much more exciting than they do played out for us in the movie.

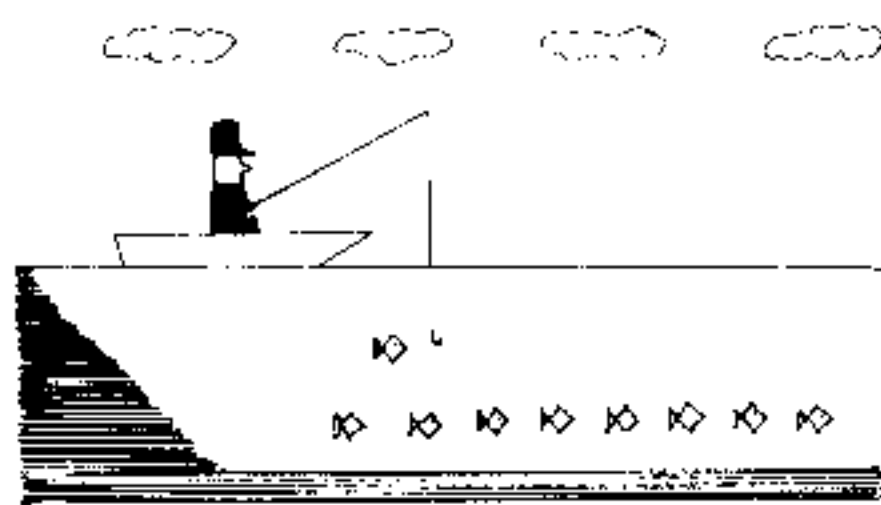
And despite some rather glaring editorial and authorial sins, and recognizing that we can't very well apply high literary standards to a reading of "the book based on the movie," we can appreciate the book's going beyond the movie to explore further dimensions of the computer question.

In addition to the book's reflections on the relationship between men and computers, for technophiles there are descriptions of David's "state-of-the-art mad hacker" home computer set-up. And though it is rather laboriously explained by David, there is a fresh metaphor drawn from computers to describe the young people's perception of most of the lives they see around them. David tells Jennifer that his parents and hers, and their teachers and the military strategists and generals are all in a continuous loop, a meaningless subroutine that endlessly repeats itself. As he and Jennifer discuss them we understand loops as neurotically repetitive behavior uninformed by a perspective on meaning or context.

The novel also undertakes to explain the attraction of computers for kids like David, something the movie shows us but doesn't really account for: "Falken had known what drove David Lightman—the fascination with such intricate toys, these fusions of metal and glass and plastic and energy, slaves to the magical chants of algorithms. No one else understood. . . what the step-by-step mastery of these machines meant to David. In their world was reason, justice, fairness, order. If you worked hard enough, you understood. . . not like life. There were rewards for accomplishments. . . not like normal life. Mastering programming was like nothing David Lightman had ever known before."

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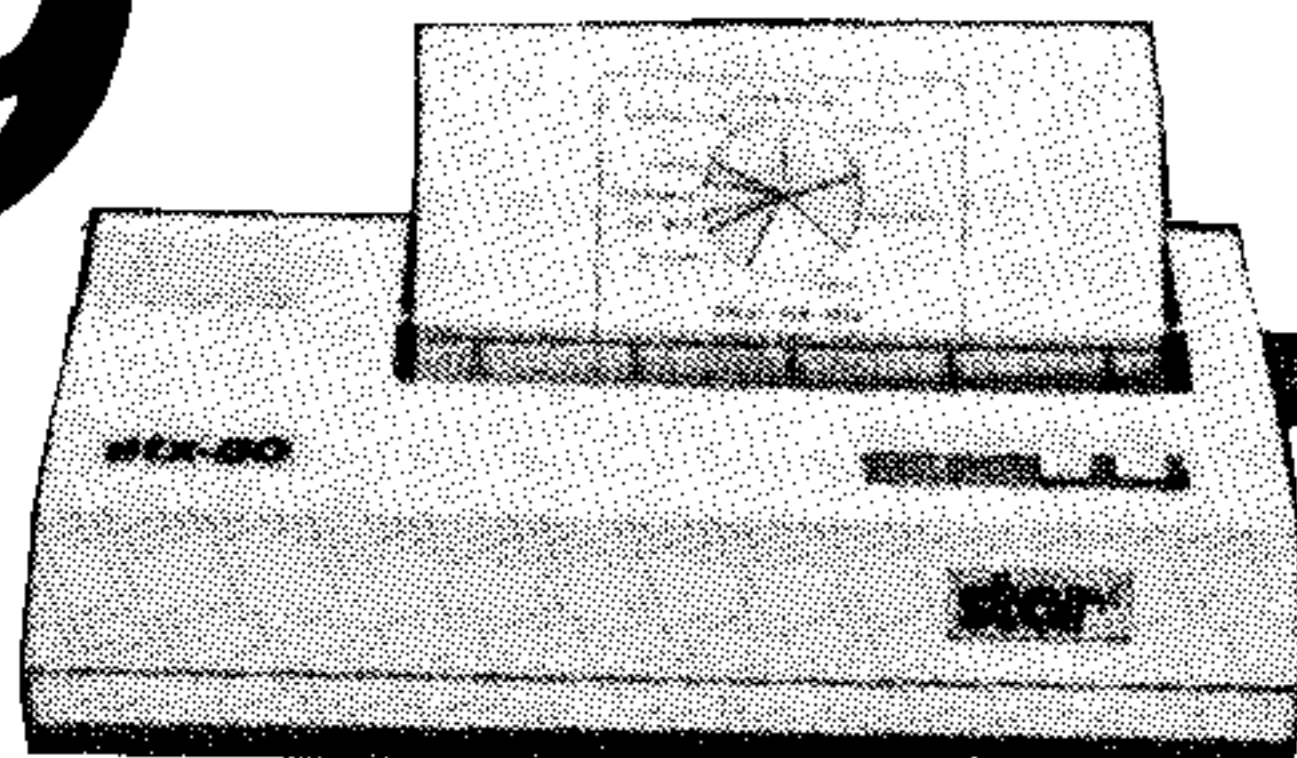
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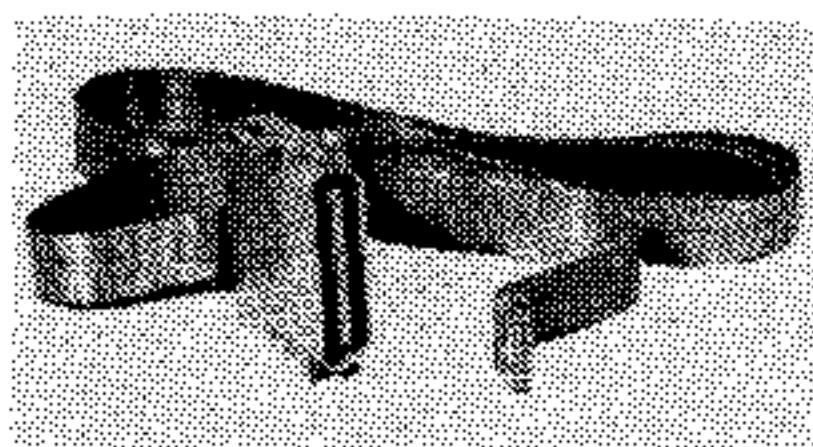
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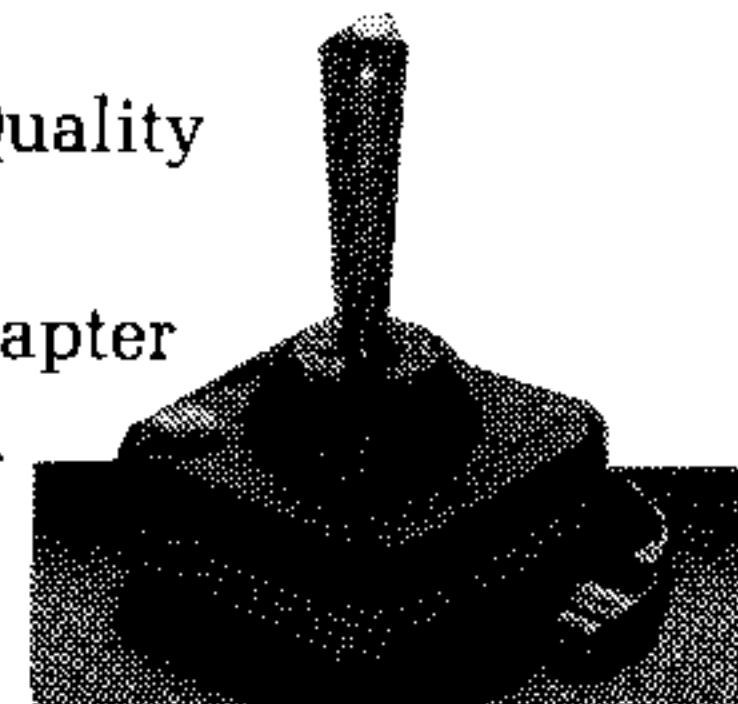
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This column is an ongoing tutorial on the *Multiplan* software package. To obtain full benefits from this column, a newcomer to *Multiplan* may find it useful to read the previously printed columns.

To err is human, and being only human we all make mistakes—including typing errors. *Multiplan* allows for this and helps you to make corrections with a nice set of editing features. This article describes these features and explains how to use them.

When I first began using *Multiplan*, I was so caught up by its calculation abilities that I neglected to learn the editing functions. When I made a mistake in a cell, I just retyped the whole thing. In retrospect, I think this cost me a lot of time and caused me a lot of frustration. So for your benefit, I have decided to cover editing early in this series.

For our purposes, editing is defined as changing something you have already typed. For starters, let's look at a common error and how *Multiplan*'s editing features allow you to correct it. Some of your keystrokes are used to select commands and options, and some are used to fill in cells of the worksheet. Whenever the word **COMMAND:** shows on line 20 of your screen, *Multiplan* expects you to type a command or enter a value or formula. It distinguishes among these by the first character you type: A letter designates a command, a digit indicates a value, and an equal sign (=) means that a formula will follow. My most frequent mistake occurs when I want to enter text (a heading or description) while in Command mode. After putting the cell pointer at the spot where the text should go, I often start typing the text right away. When I do this, *Multiplan* interprets the first letter of my heading or description as a Command letter. If I'm lucky, this letter is not a proper command and the system just beeps to indicate an error. Other times, *Multiplan* starts to execute the command. For example, if the heading I try to enter is "Schedule," the system will note the initial S and think I want to Sort something. A useful "editing" key in this case is the CANCEL key [CTRL] [=], which cancels the unwanted command. The proper action is to select the Alpha command before entering any text beginning with a command letter.

Another common mistake occurs in typing the titles, numbers, and formulas themselves: You simply strike the wrong key. If you realize your mistake before pressing the [ENTER] key, you will want to change the value right away. If you are accustomed to TI BASIC, your instinct will be to use the left arrow key and then type over the mistake. But *Multiplan* uses the left arrow in a completely different way. In *Multiplan*, the left arrow governs the cell pointer, so pressing the left arrow key has the effect of putting the incorrect value into the current cell (just what you

were trying to avoid!) and then moving the cell pointer one cell to the left. The correct way to change the last character you typed is to delete it and then retype the correct character. To delete the previous character, use the BACKSPACE key [FCTN] [9]. This technique works best if you realize your mistake right after you make it.

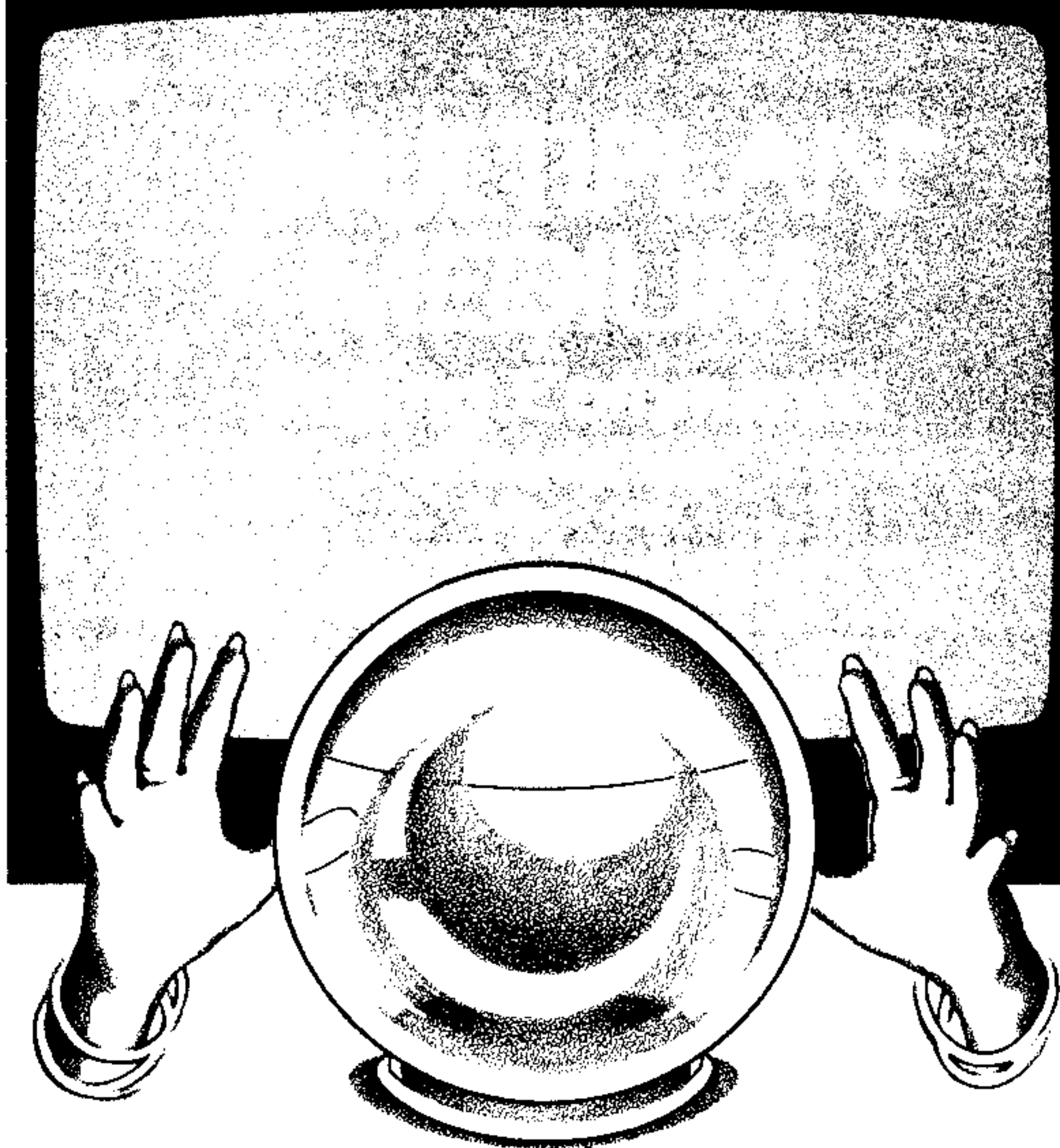
Editing Commands

A strip comes with *Multiplan* that fits on the keyboard to show the editing commands. In addition to the BACKSPACE for deletion, *Multiplan* also has DELETE FORWARD [FCTN] [0], another "destructive" editing key. When you type text, numbers, or formulas into *Multiplan*, you will notice a contrasting rectangle on line 20 or lower which shows where the next character will be placed as you type. This is called the "edit cursor." The BACKSPACE edit key deletes to

the left of this cursor; the DELETE FORWARD deletes character(s) to the right of and under the edit cursor. There are also "non-destructive" edit commands which allow you to move the edit cursor without destroying any of the information on the line(s) you are editing.

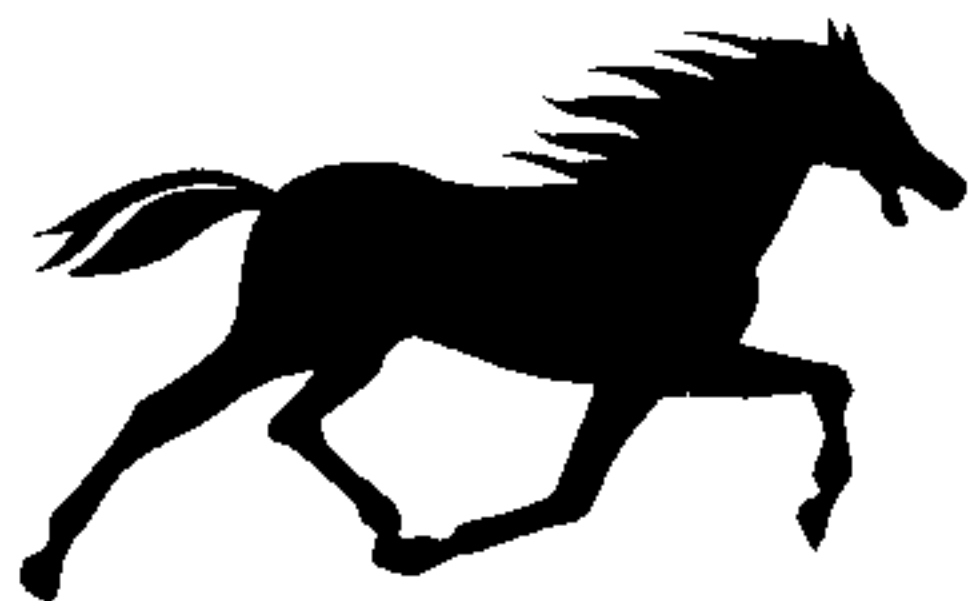
Before investigating how these editing commands are used, we should consider why they are desirable. If you notice an error on a worksheet, it is often easy to correct it by simply re-entering the whole cell. But sometimes this is inconvenient, especially when the cell contains a long formula or a long string of text. Since almost every worksheet has a title, let's use a title to show how a long string of text can be put on a worksheet and then let's come back and edit that long title easily.

As you know, each cell on a worksheet is eight characters long by default. But most titles are longer than eight characters. Suppose the title of your worksheet will be "Personal Financial Statement of P. C. Swift," and you wish to put this title on the first row of your worksheet. With your cell pointer in the HOME position and the Alpha command selected, you could enter the title in eight-character chunks as PERSONAL -> FINANCIAL -> STATEMENT OF -> P. C. SWIFT, where each -> stands for the right arrow key you press between each group of eight. This is inconvenient, especially since you have to count the spaces. And just think of the consequences if you should later decide to widen (or narrow) one of the first five columns of the worksheet—you might have to re-enter the whole title. The format code called "Continuous" is the perfect solution to this problem. Using this format code, you can define a group of cells to display the title continuously, regardless of the width of the individual cells. For the example title, it would be sufficient to define the first six cells of the first row as continuous. To do this, put the cell pointer at the HOME position. Then select



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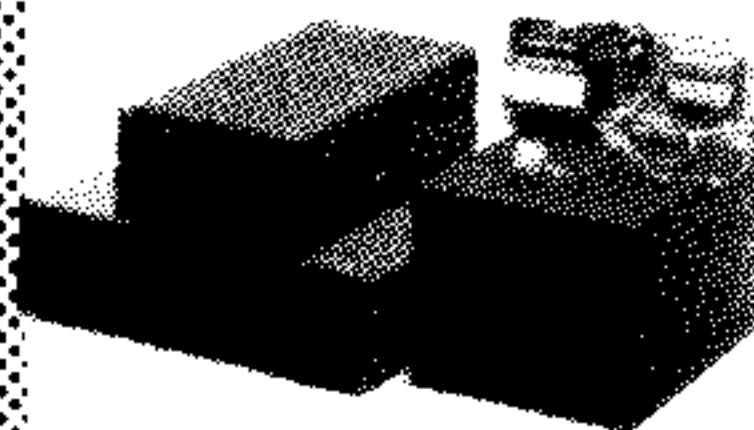


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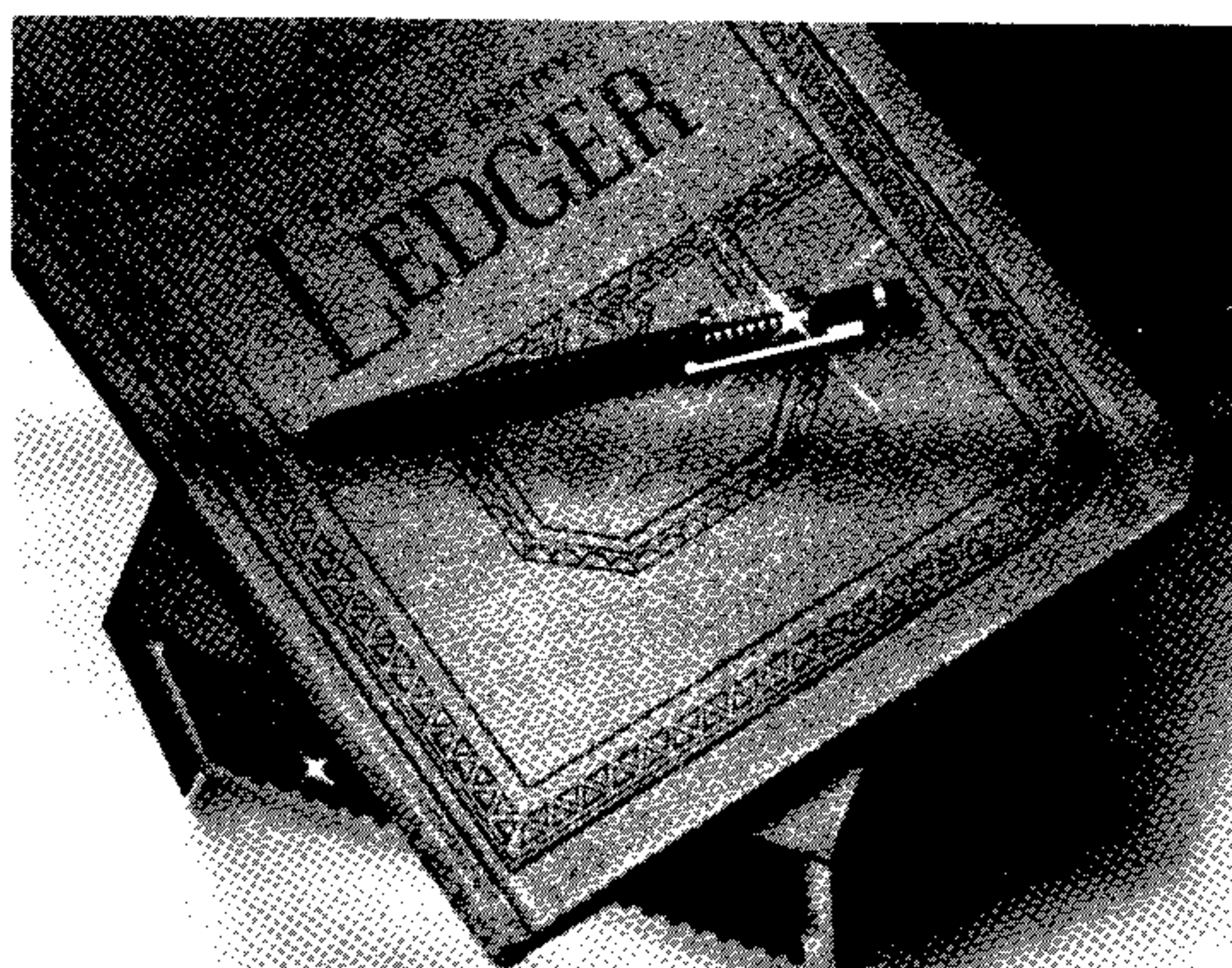
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Group Grapevine: News of TI Users Groups From Around the World.

This month's mail brought us a half-irate, half-amused letter from the **TIUP North Australia Users Group** (P.O. Box 246, Mt. Lawley 6050, Western Australia). It seems that we gave credit to the TISHUG Sidney, Australia group for an item which was "borrowed" from the TIUP's newsletter. Judging by exhibits A-C which accompanied the letter, this sort of "newsletter piracy" is rampant. While there is certainly nothing wrong with reprinting worthy articles, how about giving proper credit to the source? (TISHUG did include TIUP's tiny logo at the end of each article, but it appeared so frequently, we thought it was *theirs*.) Lest we become further embroiled in the internecine strife "down under," let us merely note that TIUP (from Perth) is responsible for the Ivan Computernutskov story mentioned in the May issue and offer apologies all 'round.

Back in the USA, we recently received the **BUG NEWS** newsletter from the **TIBUG (Birmingham Users Group)** at Rt. 1, Box 539E, Trussville, AL 35173, tel (205) 861-5630. They feature an Input/Output question and answer column, software reviews and even personal ads. (We envision some provocative entreaties: *Well-integrated micro with healthy operating system seeks user-friendly software. Object: lifelong interface.*)

The **Upstate 99/4A Users Group** plans to start Mini Memory Assembler and Extended BASIC groups to delve further into these topics. At a recent meeting, one of their members spoke on the trials and tribulations of marketing your own software. The Upstaters are interested in exchanging newsletters with other groups. Contact them in care of Michael Koser, P. O. Box 13522, Albany, NY 12212.

Toplcs, the newsletter from the **LA 99'ers Computer Group** notes that the group is offering their expertise to help new users groups organize and set up their own libraries. Incidentally, this group, which boasts "one of the largest program libraries on the West Coast," is offering mail-order membership to users outside the Los Angeles area. You can write them at I.A. 99'ers Computer Group, P.O. Box 3547, Gardena, CA 90237-7247.

From Pennsylvania, we have received the announcement that a new users group is born. The **Meadville Area TI Computer Users Group** (aka **MUG'ers**) will be holding "software buffets" monthly. Interested parties may contact William K. Dithrich at R.D. 1, Box 274, Meadville, PA 16335 tel (814) 337-9835.

Thinking of starting a users group? To be a TI-recognized group, write to Texas Instruments, Inc., Attn: Users Group Coordinator, P.O. Box 10508 MS 5890, Lubbock, TX 79408. And don't forget to write to us! For instant fame (and who knows what other goodies), direct your letters to the Users Group Editor, 99'er Home Computer Magazine, 1500 Valley River Drive, Suite 250, Eugene, OR 97401.

Letters . . . from p. 7

Dear Sir:

I am presently writing games in Extended BASIC using the CALL SAY and CALL JOYST commands with the Speech Synthesizer.

My problem is that the vocabulary of the synthesizer is rather limited and I need many more words than are available. I'm told that *Terminal Emulator II* can give me the words that I need, but it will not support CALL JOYST or CALL SAY commands or allow cassette loading.

Can you or any of your readers tell me how to get more words from the synthesizer without losing the Extended BASIC support?

Thanks for you help.

Ron Watson
Richardson, TX

Sorry, but we can't get you more words without losing Extended BASIC support. When you use the Terminal Emulator II cartridge, you can run in TI BASIC and access the TE II's features as well. So you can still use CALL JOYST and load from cassette. Instead of using CALL SAY, however, you use an OPEN file statement. Then, either any printed text or the TE II's allophones will generate speech. (See Speller in this issue, p. 29.) You can't have it both ways, Ron, at least with the standard items available.

If you're willing to do a bit of programming to dissect and concatenate parts of the vocabulary resident in the Speech Synthesizer, you may be able to use Verbose. This program ran in Vol. 1, No. 6, of 99'er HCM.

Dear Sir:

I have recently made a discovery concerning TI's Editor/Assembler. The procedure described here will allow a user to load and execute an Assembly Language program semi-automatically.

When loading a memory image program with the Editor/Assembler's RUN PROGRAM FILE option, you may have noticed that disk drive is activated even when no filename is given. Under such circumstances, the computer searches for a file by the name of DSK1.UTIL1. If this file is not found, the Editor/Assembler responds with an I/O error, just as if a non-existent filename had been given. However, if the file is found, it is loaded and executed. Thus, by having an Assembly Language program in a memory image file by the name of UTIL1 in disk drive 1, one may execute it semi-automatically by entering the Editor/Assembler and pressing 5 followed by ENTER.

I hope that this information will be useful to Editor/Assembler users.

Tarik Isani
Blacksburg, VA

Thanks for the hint, Tarik. This might be worthwhile for some often-used Assembly Language routine. To use this suggestion, follow the guide on page 240 of the Editor Assembler manual. It's necessary first to add the DEF entries to the program, then assemble and reload it. Then the Editor Assembler's SAVE utility comes into play - it saves the program in memory image format. To run it, next choose the Editor Assembler's LOAD

AND RUN option. After the first file name prompt, enter the name of the object file (DSKx.filename); after the second filename prompt, enter the name of the SAVE program (DSKx.SAVE). Those disks must be in the appropriate disk drive when referenced. When the next file name prompt appears, press [ENTER], and type SAVE in response to the prompt PROGRAM NAME. The menu will provide directions for the creation of a memory image file to be called UTIL1. Now, with the Editor/Assembler cartridge plugged in, typing 5 when the main menu appears (for RUN PROGRAM FILE) and then pressing [ENTER] after the file name prompt will automatically load and run DSK1.UTIL1.

Dear Sir:

I picked up a copy of your magazine on the newsstand today. In general, I think that it is a good magazine, but I was disappointed in a couple of the articles. In *From Cut & Paste . . . to Keystroke*, the author notes that reviewing the user's manual is important when selecting a word processor to ensure that it will meet your particular needs. But this is usually not possible when buying software for the TI-99/4A computer since most retailers do not stock a very large inventory of programs for it. The TI user must rely on in-depth reviews of software in magazines such as yours. A good review of a word processing program should be as objective as possible, and in addition to describing the major capabilities of the program, it should also describe its major limitations. That is why I was disappointed in the word processor *Market Basket* article. The author failed to mention that TI-Writer does not provide full software control of a printer or nice features like underlining or subscripting. Since there are not many word processing programs available for the TI computer, a more comprehensive review is certainly feasible.

Also, the *Drive for Diskettes* article contained some slightly misleading information. A dual-sided disk is intended for use in a dual-sided disk drive. Since these disks have only one write protect notch, they cannot be "flipped" and used in a single-sided drive unless another notch is cut. There are some disks on the market that have two notches and are intended for use in single-sided drives, but there is the possibility that the disk will be damaged, since its rotation is reversed when it is "flipped."

Andrew Van Sant
Annapolis, MD

Your reservations are well-taken. We will continue to print occasional reviews of software products, which we hope will help our readers make informed choices. You do, however, seem to have been misinformed about TI-Writer. TI-Writer has various ways of providing full software control of the printer and includes underlining as a built-in feature. Since you have full software control of the printer, you can use subscripting if your printer supports subscripting.

As far as diskettes go, Memorex markets a "Flippy Floppy" (model 3480), which has two write protect notches and two index holes and is designed to run on either side in single-sided disk drives.

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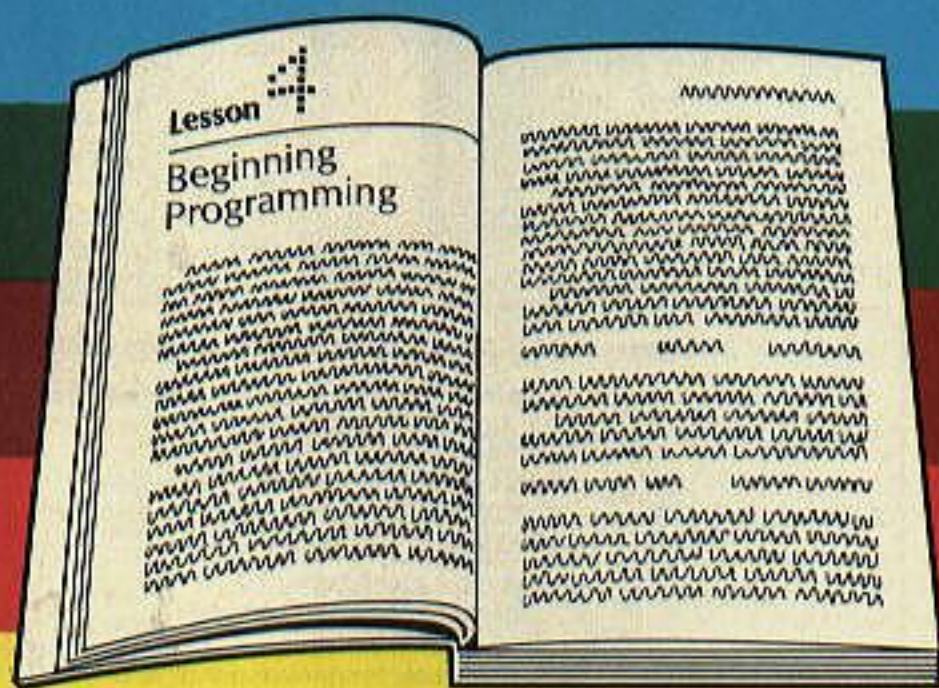
Treasure Island . . . from p. 51

```
1540 CALL COLOR(4,16,45,2):: PILO=
INT(237*RND)+1
1550 CALL LOCATE(1, SX, SY, 2, 237, P1
LO):: RETURN
1560 CALL MOTION(1, 0, -4, 4, 0, -4, 4
, 0, -4):: FOR DE=1 TO 170 :: NE
XT DE
1570 REM SCORE SCREEN
1580 CALL CLEAR
1590 DISPLAY AT(5,10): "YOU'RE SAFE"
1600 FLAG=FLAG+1
1610 BC=(B*400)+(C*600)
1620 DISPLAY AT(8,5): "YOU'VE FOUND
":BC
1630 IF FLAG=1 THEN AP=BC ELSE 1660
1640 DISPLAY AT(22,8): "PLAYER 2 IS
UP."
1650 IF FLAG=1 THEN 1670
1660 DISPLAY AT(10,8): "PLAYER 1 ":
AP
```

```
1670 IF BC>AP THEN DISPLAY AT(18,8)
: "PLAYER 2 WINS" ELSE DISPLAY
AT(18,8): "PLAYER 1 WINS" :: FL
AG=0
1680 IF BC=AP THEN DISPLAY AT(18,8)
: "TIE SCORE"
1690 CALL COLOR(1,1,4,1,45,1
)
1700 DISPLAY AT(20,4): "WANT TO TRY
AGAIN?(Y/N)Y"
1710 ACCEPT AT(20,27) VALIDATE("YN")
SIZE(-1)BEEP:YN#
1720 IF YN#="N" THEN END ELSE 1340
1730 CALL CLEAR :: FLAG=0
1740 DISPLAY AT(4,4): "XXX YOU'VE BE
EN CAPTURED XXX" :: GOTO 1670
1750 CALL CLEAR :: FLAG=0
1760 DISPLAY AT(4,4): "XXX SNAKE BIT
E, YOU LOSE XXX" :: GOTO 1670
```

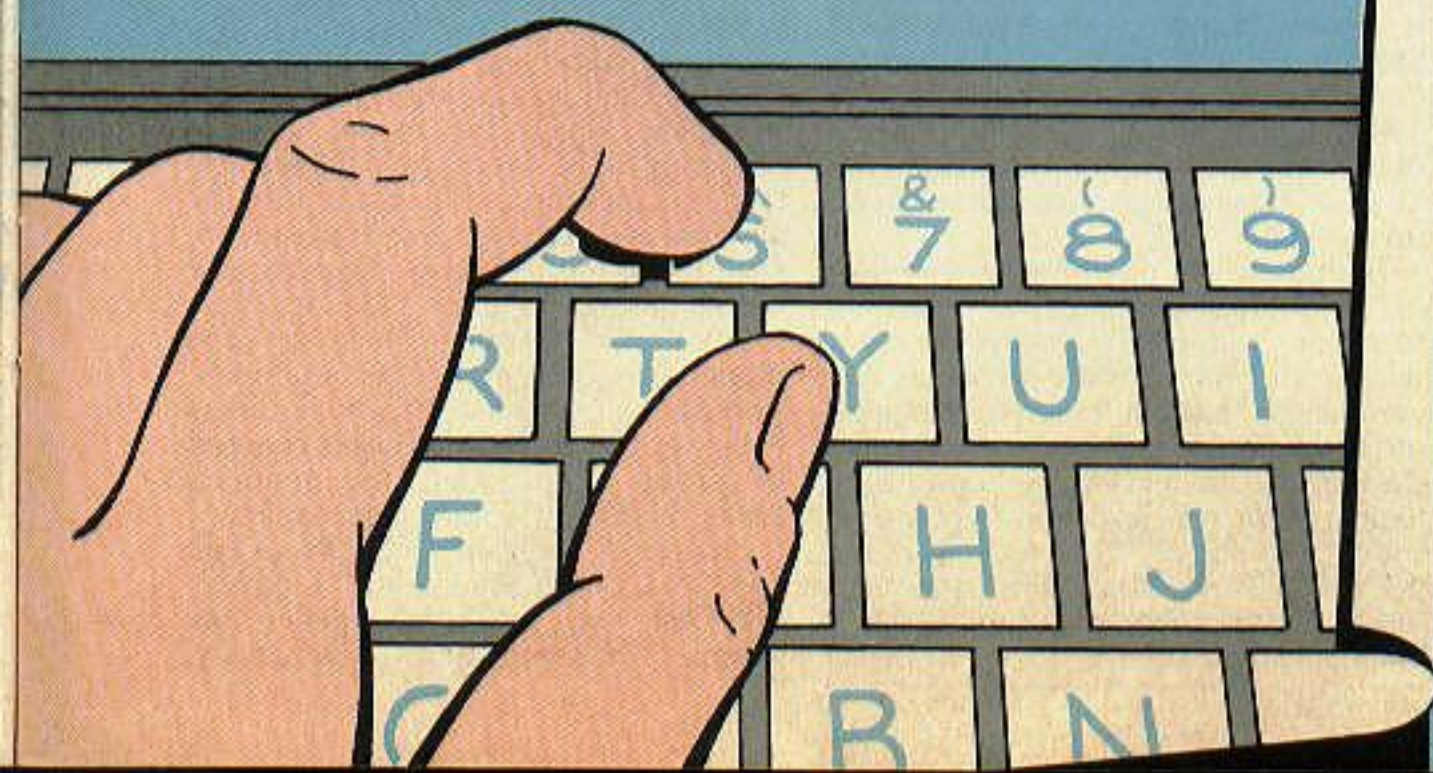
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A Book Review of LEARN BASIC

By Robert Ackerman

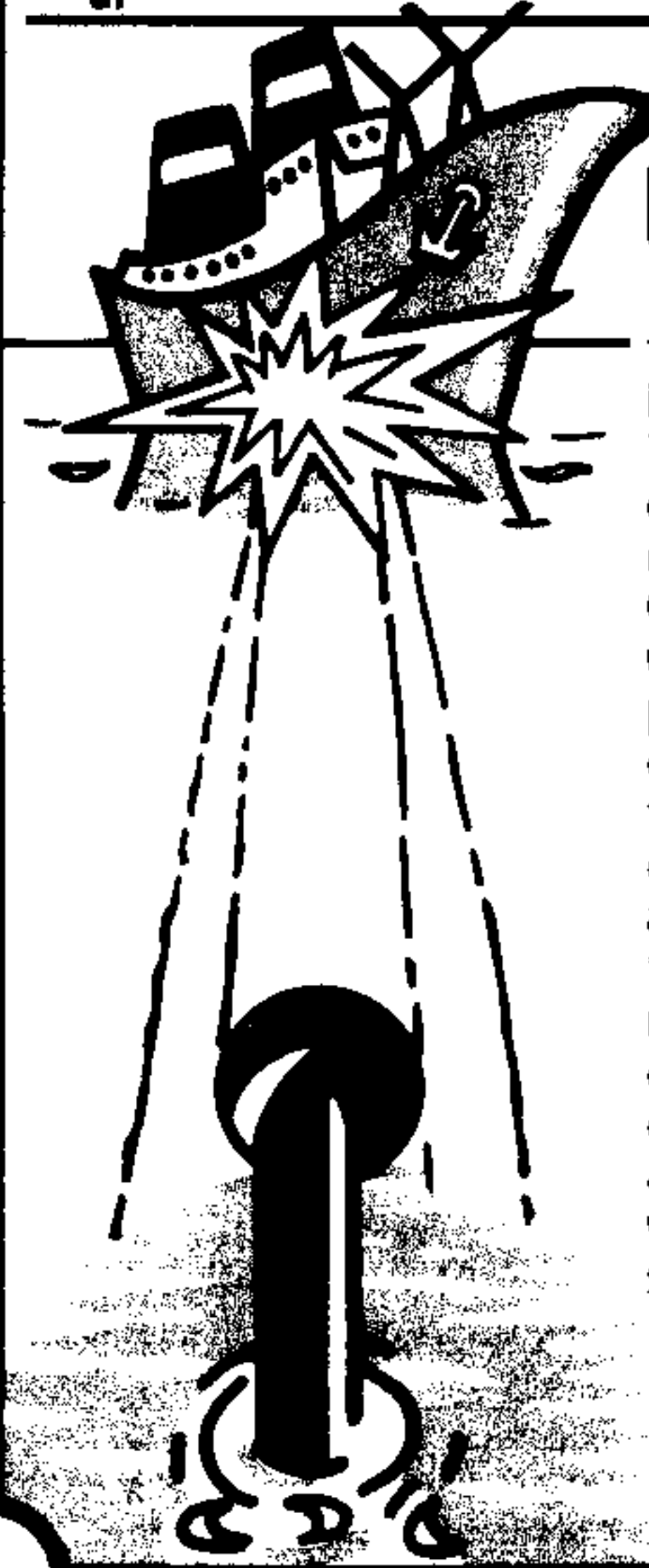
Technical Editor

Name:	LEARN BASIC: A Guide to Programming the Texas Instruments Compact Computer 40			
Author:	David Thomas			
Publisher:	McGraw-Hill, Inc.			
Price:	\$9.95			
	Poor	Fair	Good	Excellent
Clarity:	=====			
Comprehensiveness:	=====			
Usefulness:	=====			

The manual is bigger than the computer—that's the hallmark of the newest generation of computers. The ability to pack more and more into less and less space has left design engineers with only two real constraints: that (1) displays be big enough to see, and (2) keyboards be big enough to manipulate. The increasing complexity and capabilities of large-scale integrated circuits, coupled with their decreasing size and power requirements have made this freedom possible. Unfortunately, the wordsmiths haven't enjoyed the same release. Not only do they have to cope with the same old language—quirky, murky English as she is wrote—but they have increasingly complicated subjects to cover. It's a wonder that the users can ever understand their systems from the manuals they're given. Complaints about the quality and clarity of the written materials are a commonplace in the computer field.

Although the CC-40 springs from this generation of tiny computers and giant manuals, its *User's Guide* is clear and well-organized. In particular, the "Reference Section," which takes up most of the manual, is very helpful. The alphabetical arrangement by keyword, a feature of TI's other manuals, lets you find what you need quickly and painlessly. Painlessly, that is, if you need to refer to it for only the fine points—such as how to format the parameters for PRINT. But if you're not already a programmer, the CC-40 *User's Guide* may make for tough sledding. The *Guide* throws out a gentle hint to that effect in Chapter One. There, on page three, amateurs are advised to look elsewhere for

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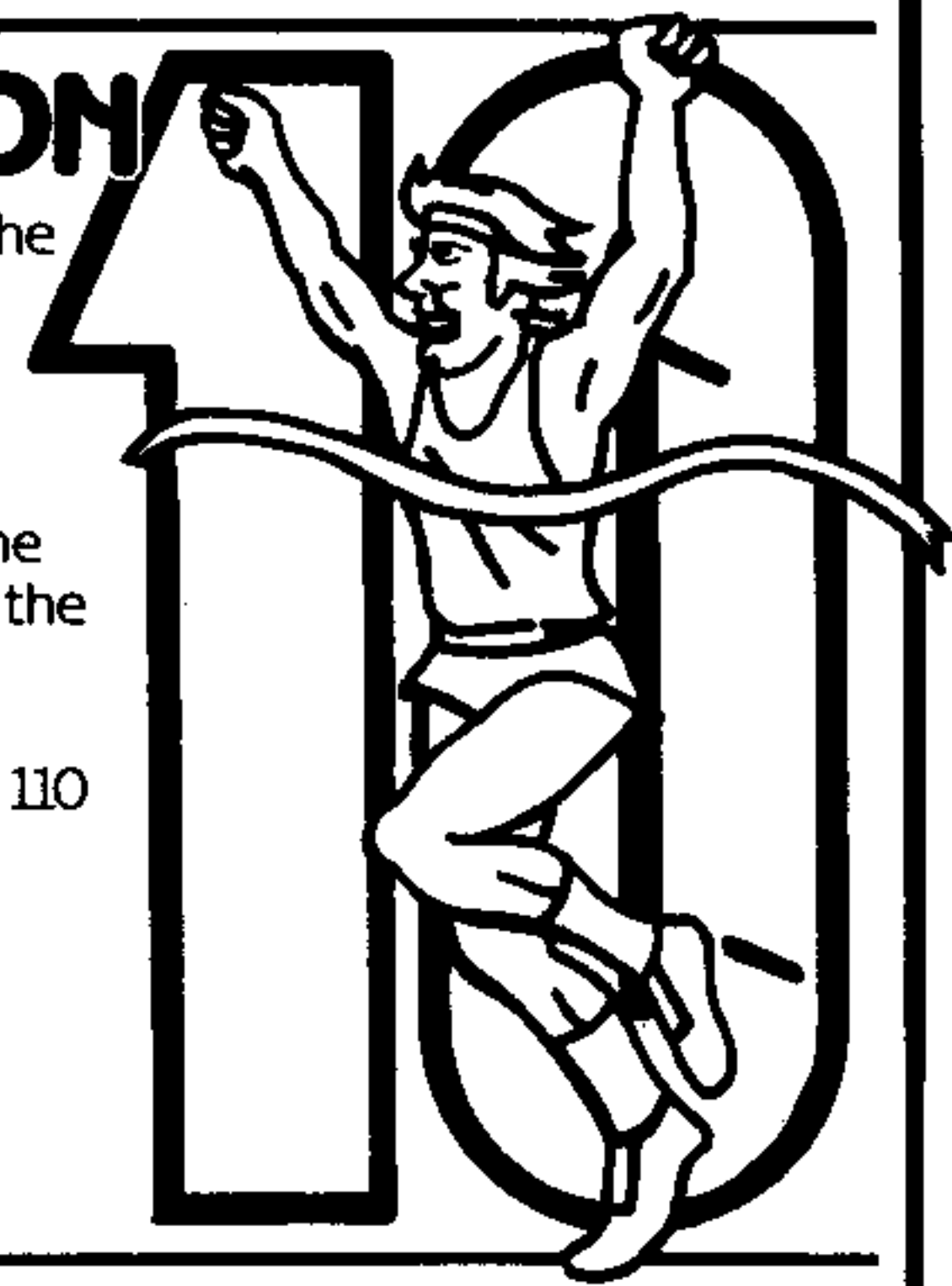
You are the skipper of the USS Porpoise on patrol in the Western Pacific. "Final Bearing Mark—310 degrees." "Final Range Mark—3,000 yards." "Fire One!" "Fire Two!" You watch through the periscope just long enough to see two torpedo wakes converge on a 10,000 ton tanker and send it to 'Davy Jones Locker.' "Take 'er deep; right full rudder; rig for depth charge." The destroyer escort has already started looking for you. Written by a 20 year submarine veteran.

(Extended BASIC Only)

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(BASIC Only)



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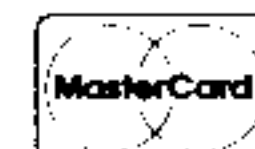
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the introductory fundamentals.

Specifically, the manual refers neophyte programmers to *Learn BASIC: A Guide to Programming the Texas Instruments Compact Computer 40* by David Thomas. Many CC-40 owners bought the computer thinking that they would find all their needs satisfied by available applications software on cartridge or wafer tape. They may later decide that they need to be able to program the computer rather than just feed it canned programs. Herb Shanzer, product manager of the Texas Instruments division responsible for the CC-40, feels that the machine lends itself to this switch in usage. The CC-40 "is [also] appropriate for the technical user, and we plan on supporting that technical use in a fashion that is commensurate with his abilities," Shanzer said in an interview with *Portable Computing Magazine*, (99'er HICM, April 1983). Thomas's book contributes to part of that support. Programming tools from TI, plus tutorials in this magazine will make up the rest.

Thomas, who is described on the cover as "a writing consultant to Texas Instruments with years of experience in writing for programmable products and computers," has put those years to good use in the production of this book: He has developed an excellent home-study tutorial for the rank beginner. Twenty-eight short chapters, or "Lessons," take you from the very basics the *command mode*, or computer as calculator—through branching and decision-making to logical

operations and subprograms. That's a lot of material to get through, but this book does it lucidly and succinctly.

Each lesson is neatly self-contained, and short enough to comprehend before fatigue sets in. Learning programming can be hard work, especially since computer books often seem to have their chapter lengths determined by the language's structure rather than the learner's ability. In contrast, the longest lesson in this book takes up just nine pages; the shortest, just three. It's possible to work through most chapters easily in an hour or two and at the end of that time have a working knowledge of the material at hand.

The author clearly believes in learning by doing. All the lessons lead the reader through concrete examples of the programming command or statement to be learned. Each lesson begins with simple examples, which the reader keys in according to the directions in the text. He then executes the commands or runs the program and compares the responses obtained with the responses the computer should display in each case. In every chapter, the examples build on and modify previously-completed examples. And where appropriate, the book carries earlier examples over into later chapters in order to broaden the reader's understanding of a particular feature.

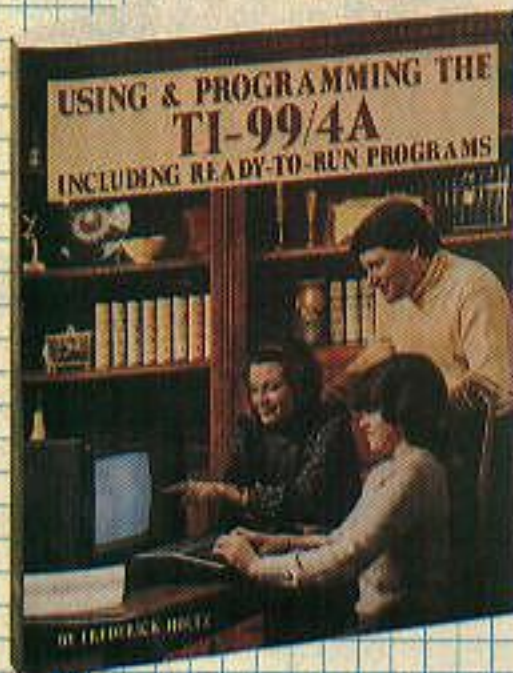
Chapter 27, entitled "The ON GOTO and ON GOSUB Statements," is typical. The first two paragraphs define the statements in general terms—that is to say,

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in English—and then go on to give a precise definition in terms of BASIC syntax. An example of each statement, complete with an explanation of the results of its execution, follows. In order to demonstrate the different possibilities for control of branching, one statement uses a simple variable; the other uses a numeric calculation. Two short programs round out the chapter. Again, each has an explanation and a section detailing the results when the program runs with various inputs. In addition to being short (26 and 33 lines, respectively), the programs may even be useful. One is a metric conversion program; the second calculates the day of the week for any date after the year 1582. The chapter ends with a concise summary of the salient features of the two BASIC statements. All in six pages.

At the end of each chapter, there is a short recapitulation of its principal points. This may be overkill. Most of the chapters are so short that skimming them should be sufficient for most readers to pick up the high points of that chapter. But Thomas obviously has a program and intends to stick to it.

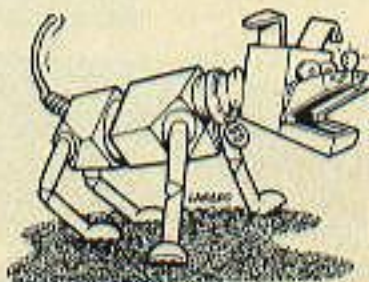
To help beginners make sure that they've grasped everything they've studied, a "Review Test" follows every few chapters. Each test has some easy questions and some hard ones. Some require only the distinction between correct and incorrect; others require the writing of actual programs. The answers to all the questions are in the back of the book, naturally.

Another thing that's gratifying to see is a useful index. It even lists the often-used keys.

At the beginning of the book, Thomas assumes that his readers know little more than how to turn the machine on and off and how to edit the lines of text they enter. By the time he's done, they'll have a good grasp of the skeleton of the language. For instance, they'll know about using logical operators to branch to subprograms—not only know what that phrase means, but how to do it. Computer competence in twenty-eight days? No, but at least a high degree of computer confidence.



May's Choice



Our readers have spoken. The winner of the May B.A.R.C. Back competition is B. J. Bruns for his game, *Lost Ruins*. Our hearty congratulations and a \$100 prize go to Mr. Bruns.

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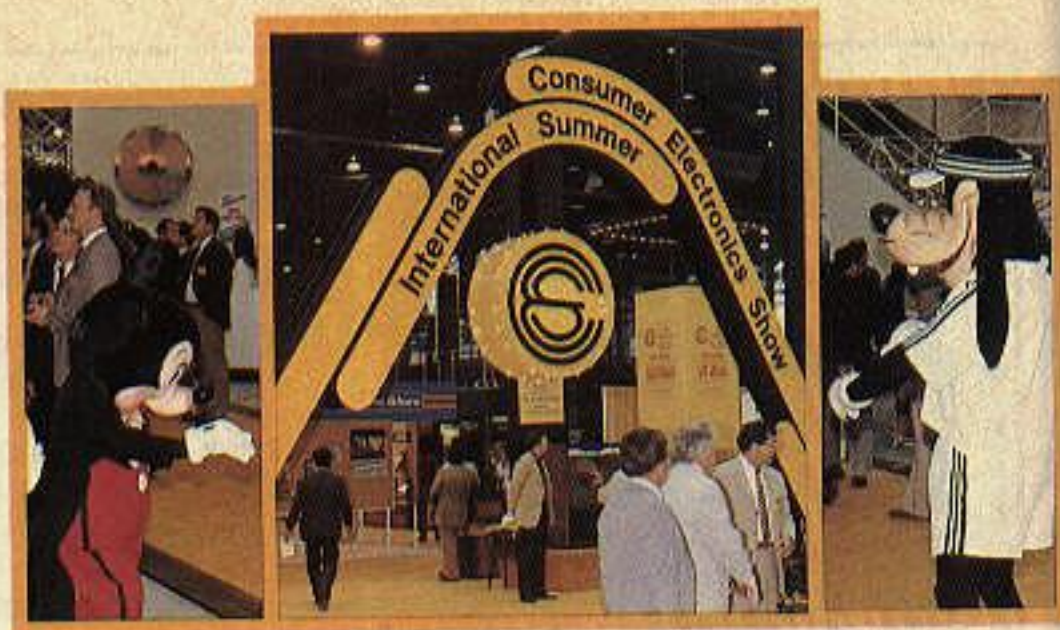
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TI & 99'er at the Summer Consumer Electronics Show

—Chicago
June 5-8, 1983

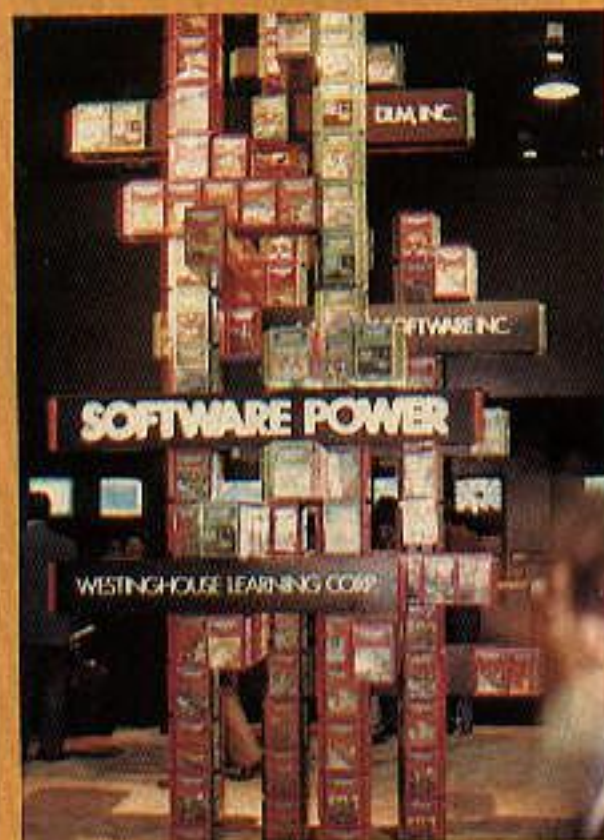
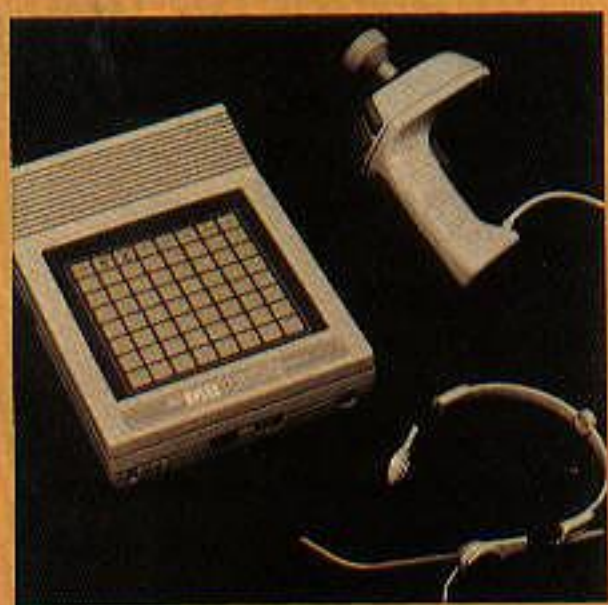
By Gary M. Kaplan



It was a record-breaking, four-day event—and one of great significance to anyone who presently owns, or is thinking about buying, a home computer. Nearly 84,000 attendees from over 70 countries swarmed through the three-quarter million net square feet of exhibit space where 1,275 firms displayed their wares. The place was Chicago; the time, the first week in June; and the event was the Summer Consumer Electronics Show (CES).

Long-time readers of this magazine who are familiar with our coverage of the semi-annual CES already know that the January show is customarily "the big one" because of its Las Vegas setting. After all, the dream of a brief "working vacation" in mid-winter among the 3G's of Vegas (Glamour, Glitter, and Gambling) just has to be a stronger draw than the thought of O'Hare Airport and the "Windy City" in early summer. Chicago might cause Frank Sinatra to croon about its being his "kind of town," but for most consumer electronics buyers, Wayne Newton's voice from the desert wins hands down.

The larger-than-expected turnout in Chicago was therefore surprising. Most industry analysts agree that the record attendance reflects an industry-wide confidence in the nation's economic recovery and a corresponding anticipation of a tremendous holiday selling season around the corner.



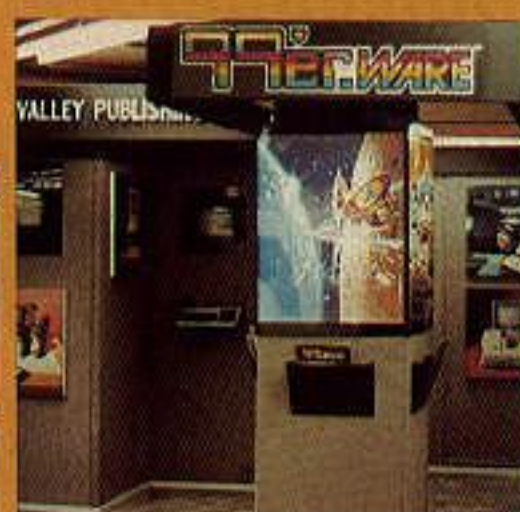
Although CES covers such diverse consumer niceties as stereo components, video camera and taping equipment, laser disks, satellite Earth stations, electronic telephones, radios and TVs, microwave ovens, and digital watches, the real action at the June event was in home computers and video games. In fact, a separate building, McCormack West, was devoted to housing the beeps, blasts, flashes, synthetic speech, and printer pounding from 200 computer and games exhibits.

There was a world of difference between Chicago's message and that presented to the industry and press in Las Vegas just five months earlier. With virtually every major video game software manufacturer announc-

ing forthcoming titles for the most popular home computers, it was finally clear to all that the battle that had been predicted between the dedicated game consoles and the more versatile expandable computers wouldn't even take place: It will be just a matter of time before the game-only machines go the way of the dinosaurs. And with what is actually too much a variety in software, there will be more products than the country's retailers—whether small independents or mass merchandisers—can stock on fall and winter shelves. It doesn't take a video game guru to see the proverbial "handwriting on the [electronic] wall..." A massive shakeout is definitely coming!



THE MAKING OF A CES EXHIBIT



The air-freight "Igloo" with over 5000 pounds of pre-fabricated (in Eugene, OR) exhibit structure arrives at McCormack West. The finished "house"—complete with roof, windows (for the computers and videotape machines), and back rooms—gets erected in one very long day. (A few minutes of early panic occurred when the assembly directions could not be found!) At the end of the second day, everything is in place—backlit art, photo murals, "floating" light boxes, hands-on demonstration stations, and literature displays. At the close of CES four days later, it will all be repacked in its igloo bound for home.

Texas Instruments surprised many showgoers with its exercise in restraint by neither publicly demonstrating nor officially announcing the new 99/8 Home Computer at CES. [See the "99'er Digest" on p. 35 in last month's issue of this magazine for a synopsis of new TI products actually announced at CES.] Instead, the huge two-story Texas exhibit invited showgoers to get familiar with the new-look beige 99/4A, more compact Hex-bus peripherals, the Milton Bradley MBX Expander voice recognition unit (shown in its new and matching beige case on p. 64), and with preview demonstrations of a small sampling of the mountain of software releases due in time for holiday shopping.

In a move that signified the first step to maturity in an infant industry still feeling the pangs of birth, the Texas giant delivered its message loud and clear: Product announcements too far in advance of availability serve no purpose other than media hype and do, in fact, frequently back-fire—damaging the credibility of manufacturer and industry alike. Too much lead time can dull the manufacturer's capacity and motivation to deliver what has been prematurely announced. This is especially true if the market and competition reacts in an unfavorable way to the announcement. In a flashy industry whose most-publicized innovators have not yet attained the age of thirty, TI's reluctance to



OUR ADVERTISERS MAKE THEIR PRESENCE FELT AT CES



Leading Edge exhibited their Gorilla Banana (dot-matrix printer) which had a lot of a peel. . . MYARC's WDS/100 Winchester disk system for the 99/4A was demonstrated at the Texas Instruments exhibit. Jim Schwaller (center, facing camera) of Extended Software visits the 99'er-WARE booth for a friendly chat.

show a product too soon before the consumer can find it in the store is admirable. We can probably expect to see the 99/8 announced in early fall when the product should be available for the stocking of retail shelves—and not before.

One of TI's software demonstrations—in the shadow of its massive, illuminated building-block software monolith—made it obvious to our 99'er correspondents that the new offerings this fall would finally elevate the color graphics display capability of the 99/4A to the place where it belongs. In a surprise announcement, TI told the industry that it had secured the rights to manufacture and distribute seven Imagic programs in Command Cartridge format. The first of these, *Microsurgeon*, was demonstrated in TMS9900 code running in a fully-configured 99/4A system under the Editor/Assembler. It impressed us so much that it

graces this issue's cover. [See our lead article on p. 8 for a look at the type of graphics you can expect on other software packages announced by TI.]

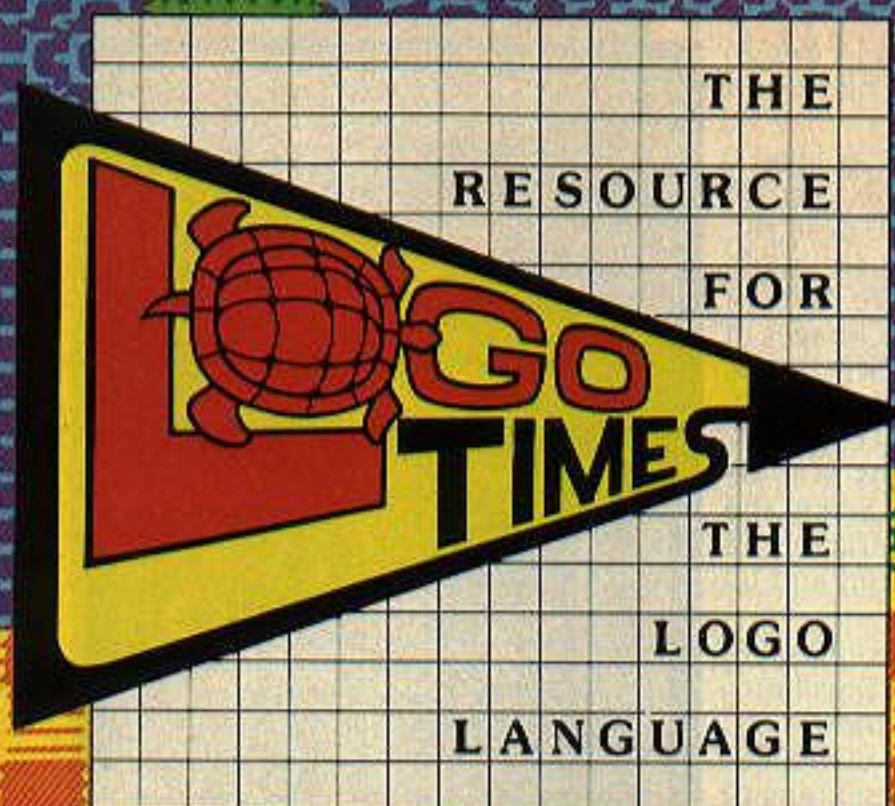
This was a good show for measuring the proliferation of the 99/4A in the consumer market because quite a few other hardware, software, and accessory manufacturers and distributors used this popular machine in their booths, most notably Milton Bradley (with the MBX Expander and game cartridges), Scott Foresman (an assortment of education cartridges and administrative programs), Funware (game cartridges), ROMOX, (game cartridges and a side-port cartridge adaptor), Percom Data (an add-on disk drive/controller unit), Keystone Marketing (an active TI distributor), and our own 99'er-WARE (with a new line of low-cost cassette-based software and books).

As part of the Emerald Valley Publishing Co. (the corporate parent of both 99'er HCM and 99'erWARE) booth, our attending magazine correspondents had a unique reporting perspective. We were on the "outside" (as press) and the "inside" (as exhibitors)—a position that made us sensitive to the new-product information needs of the press on the one hand, and the dual publicity/secretcy needs of the exhibitors on the other.

Our own 99'er-PAK™ product concept—a quality collector's case containing a program cassette and a flip-card book with lessons in computer literacy (all for under \$10)—was well received by the industry. The 99'er personnel who tended the booth had the pleasure of demonstrating the new products and meeting with many of our magazine advertisers, local users group members, other readers and members of the consumer electronics press, as well as with many new distributors, dealers and manufacturer's representatives in the U.S. and worldwide.

Chicago CES was also the occasion for 99'er HCM to celebrate the anniversary of its two years in print. We thank all our friends who were able to attend—sharing some food and drink, and placing bets on when the massive double-nine ice carving (shown below) would melt down and fall over. (It never did!)





Mosaic Designs

A Response to
Muller's Challenge III
By Roger B. Kirchner

Stung by criticisms of TI LOGO's alleged deficiencies, Jim Muller, President of the Young People's LOGO Association, posed three challenges for LOGO programmers—appealing to his fellow LOGO devotees to come up with solutions to redeem TI LOGO's reputation. Roger Kirchner responds here to the third of those challenges: that someone "write a multicolored tessellation procedure," for "multi-colored mosaics that graphically represent multiple depths of recursion."

A procedure is recursive if its definition refers to itself. With regard to graphics, the term refers to a design composed, in a regular way, of designs which are similar to (though they may be simpler than) itself. LOGO has a recursive capability which can answer Muller's challenge to produce recursive designs that fill the screen.

Those familiar with TI LOGO know that the TI Turtle can draw on only the central 30 character positions of the top 16 lines of the screen, and can draw on only 192 of these 480 character positions. The original 99/4 did not have a bit-map mode, and although the 99/4A does, designers have stayed with the character graphics mode for LOGO because of the extensive memory requirements of the bit-map mode.

Even though the turtle itself can't fill the screen, TI LOGO has graphics objects called *tiles* which can. Each of 255 8×8 pixel tiles can be arbitrarily defined using MAKECHAR or MC, and placed anywhere on the 24×32-character screen. (MAKECHAR works just like MAKESHAPE, which is used for defining shapes for sprites.) Also, any of 16 colors can be assigned to the foreground and background in groups of 8 tiles. Tiles are, therefore, perfect for constructing certain kinds of recursive designs.

Multilevel Designs

Recursive designs can be described by level designations. A primary design can be designated the level 0 design. A level 1 design is composed of level 0 designs. In general, a level L design is composed of level L-1 designs.

To illustrate, let's define a checkerboard as an example of a mosaic design. An 8×8 checkerboard could be described as a level 3 design with each of its 4×4 corners a level 2 design, each



Introduction

LOGO Times is an information resource for anyone interested in participating in the creation of their own *personal language*—one that will easily allow them to communicate with a computer in a totally new audiovisual realm of applied imagination, exploration, and self-discovery. The articles on these pages concern the use of the new TI LOGO language, but readers do not need any additional software or equipment (or even a computer) to understand and learn from the material presented here.

If readers want to actually *experience* a TI LOGO environment, they will need either a TI-99/4 or TI-99/4A computer, the Expansion Memory peripheral, and TI LOGO Command Cartridge. A disk drive, although convenient to have, is *not* required; a user's work may alternately be saved on cassette tape, printed out on the TI Thermal Printer, or hand copied into a notebook (for later re-keyboarding).

In each issue, one or more of the articles may reference or build upon the topics discussed in a previous article. It is therefore recommended that for maximum benefit and understanding, new readers obtain the appropriate back issues of *99'er Home Computer Magazine* containing **LOGO Times** articles.

NOTICE

LOGO Times is actively soliciting articles. Manuscripts should be typed double-spaced, and accompanied by a cassette tape or disk if containing any lengthy procedures or graphics.

Send all materials to:

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All mail directed to the Letters-to-the-Editor column (*Letters on LOGO*) will be published in accordance with the conditions set forth on *99'er Home Computer Magazine's* Masthead page.

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LOGO Times is a trademark of
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of whose 2×2 corners is a level 1 design and whose four squares are black and white level 0 designs.

We will use individual tiles as level 0 designs. A level 1 design will be a square composed of four tiles (level 0 designs). A level 1 design will be a square made with four level L-1 designs. We think of the level L-1 designs as mirror images of each other, even though this will be the case only for special level 0 designs. Level 4 designs will be 16×16 character squares, and level 5 designs will be 32×32 character squares. Since the LOGO screen is 24×32 characters, a level 5 design will wrap around and fill the screen.

Use MC to design patterns for tiles 96, 97, 98 and 99. Then DESIGN 0 will produce a level 5 design using these tiles. SCOLOR will cause the color of the tiles to change randomly at the beginning of each level 3 design. The background color is sometimes black and sometimes white. DESIGN uses DES to do the work. When the design is complete, it will be repeated, but the only visual evidence of this will be an occasional color change. Figure 1 shows the pattern produced if the four tiles are numbered 1-4.

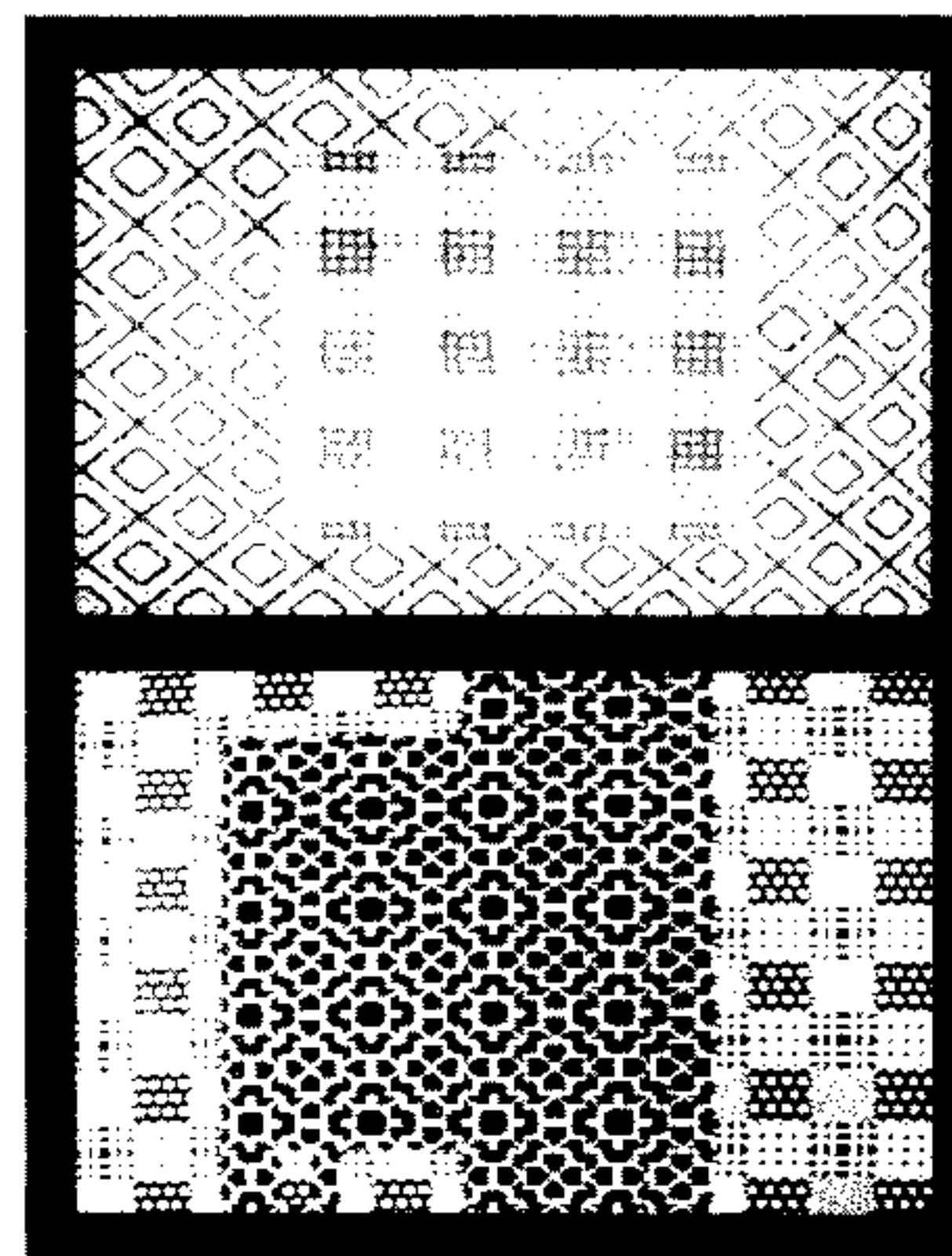
If tiles 100-103 have been designed, DESIGN 1 will produce the mosaic generated by these tiles and then the mosaic generated by tiles 96-99. The two designs will alternate. If tiles 96-99, 100-103 . . . $(96 + 4K) - (99 + 4K)$ have been designed, then DESIGN K will repeatedly produce all the designs beginning with the one generated by tiles $96 + 4K$ to $99 + 4K$. For example, DESIGN 7 will first produce the mosaic using tiles 124-127, then 120-123, and so on.

Plotting the Pattern

The main work is done by DES, a procedure with six inputs. The first two inputs locate the beginning corner of the design. The next two inputs are given values 1 or -1 and determine the direction in which the pattern will develop from the beginning corner. The fifth is the level, and the sixth determines the tile that will be plotted if the level is 0. Figure 2 indicates the directions in which the level L-1 designs are generated relative to a level L design.

Figure 3 provides some tile designs that will result in an attractive mosaic. But your own imagination and recursion will produce even more exciting patterns.

As an aid in creating designs, try the following: Design tiles 96-99 using MC, run DESIGN 0 to fill the screen, and press [BACK] to stop the procedure. Then use MC to redesign tiles 96-99 without clearing the screen. You will instantly see the results of your changes. Another tip: Save procedures and shapes and tiles. Then you won't have to redo old designs and can concentrate on making new ones.



This new microworld of mosaic designs will provide many hours of discovery. The artist in you will want to experiment with patterns and colors. The mathematician in you will wonder what kinds of symmetries can be generated. Use your imagination and creativity to explore and extend the possibilities.

```
TO RND :N
1:
MAKE "RND 10 * RANDOM +
RANDOM
IF :RND < 100 / :N THEN OP :RND /
( 100 / :N)
GO "1
END
```

```
TO PLOT :X :Y :K
PT 95 + 4 * :P + :K :X 23 - :Y
END
```

```
TO SCOLOR
IF NOT :L = 3 THEN STOP
MAKE "C1 2 + RND 13
MAKE "C2 1 + 14 * RND 2
SC SE :C1 :C2
END
```

```
TO DES :X :Y :U :V :L :K
IF :L = 0 THEN PLOT :X :Y :K STOP
DES :X :Y :U :V :L - 1 1
DES :X :Y + H * :V :U (-1 :V) :L - 1 2
DES :X + H * :U :Y + H * :V (- :U)
(- :V) :L - 1 3
DES :X + H * :U :Y (- :U) :V :L 1 4
END
```

```
TO DESIGN :PO
CS
CB :BLACK
MAKE "P :PO
1:
IF :P < 0 THEN MAKE "P :PO
TELL TILE 96 + 4 * :P
DES 8 4 1 1 5 0
MAKE "P :P - 1
GO "1
END
```

```
TO H
MAKE "H 1
REPEAT :L [MAKE "H :H * 2 ]
OUTPUT :H - 1
END
```




To Model is To Learn

By William M. Goodman

This column marks the beginning of a new feature in *LOGO Times*. Its title was deliberately chosen to reflect the meeting-of-minds which LOGO encourages. For although "LOGO" has come to suggest the innocence of children engaged with turtles, sprites, and simplified programming, the term "logician" conjures up the more forbidding intellectual who (like *Star Trek's* Mr. Spock) absorbs himself in the cold and remote beauties of abstract thought. The beauty of LOGO, however, is that it can offer its riches to *anyone* who wants to *learn*—children, intellectuals, and everyone in between. The aim of this series is to explore how the elegant simplicity of LOGO can assist in thinking and learning at *any* level.

The obvious potential for learning with LOGO is associated with children in elementary schools and older students in physics and geometry. We'd like to suggest that LOGO can contribute fruitfully in any setting where people need to increase their knowledge and understanding. This series will emphasize the many ways in which LOGO can assist human learning in such areas as decision making, theory modeling and logical evaluations.

If any one feature of LOGO can be said to contribute most to helping people learn, it would have to be its tremendous facility for helping people *model* what is being studied. Much attention, it is true, has been focused on LOGO's well-known graphics and user-friendliness. To be sure, all users hope to take advantage of these LOGO qualities, but even BASIC can (with effort) produce quite admirable graphics.

It is LOGO's adaptability to the modeling process which makes it the potentially stronger learning tool.

A Role Model

It is no accident that LOGO is better suited for modeling than most other available languages. In a frequently quoted passage, Seymour Papert, one of the original developers of LOGO, says that "Children learn by doing, and by thinking about what they do." For Papert, this is the very core of the LOGO philosophy, and it applies to all learners, regardless of age. We are all "children" when it comes to learning something for the first time. People learn by constructing models and by reflecting as they perform the process. As children learn to speak, for instance, they begin by constructing their own models, or hypotheses, of what their native tongue is like. Thus, they come up with unique expressions like "Me, juice" or "Downstairs go" or "Me no like," which they have never heard from their parents or peers. These "mistakes" seem quite natural if we view them as the children's tentative models for how sentences are to be constructed. As experience leads the children to recognize the limitations in their own models and to construct revised and more accurate versions, then we say that they are learning their language.

In the classic application of LOGO, this same educational sequence occurs. LOGO was designed to enhance model construction and to encourage reflection. The child who attempts, for instance, to draw a house on a monitor using LOGO commands is, in effect, constructing a model for the house on the screen. As the learner attempts to reproduce the angles and shapes of the real thing onto the monitor—and to debug mistakes which occur—the learner is at the same time discovering the nature of the thing itself. For the person who engages in such a LOGO activity, the seemingly separate processes of modeling, debugging and understanding the world become blended into a *single* process.

Suppose, for example, you attempt to draw a window by telling the turtle to turn RIGHT 87 at every corner. You will soon discover that this plan doesn't work, and in your attempts to correct the design you will be discovering some crucial details about actual windows—their usual angles, for example.

Since the primary purpose of this first column of is to introduce the series, no large-scale LOGO project will be attempted. But as an illustration of how LOGO can be used to explore a subject of interest, we provide the following example. This illustration will answer the question, "How can one model alternatives in LOGO?" At the same time, the modeling and debugging process will lead us to a finer understanding of what we mean when we speak of "alternatives."

Modeling Alternatives in LOGO

In English, we indicate alternatives by saying "Either A or B" to represent the op-

tions. For example, if one's clothes are getting too tight, one can say (1) "Either my clothes are shrinking or I am gaining weight." Or one can represent alternatives by saying (2) "Either that creature is male or it is female." Both examples use the same standard English-language format, "Either A or B." But suppose you were constructing a LOGO model and the outcome depended on whether the alternatives, as stated, proved to be true or false. If you assume that one *single* model is sufficient to represent *both* the above "either . . . or" expressions, you will quickly discover that the single model you chose often gives bad results. This corresponds to trying to model the angles of a window with 87 degree turns: By the time the picture is completed, you discover that the shape produced does not correspond to the object being modeled. Similarly, any attempt to model "alternatives" in LOGO will force you into the recognition that, in fact, there are *two* types of choices represented by examples (1) and (2)—each of which requires its own distinct model.

In TI LOGO, the "either . . . or" construct presented in example (1) is built in as a primitive command: EITHER condition 1 or condition 2. It is this version of choice which is often written in English as "and/or." The statement is "true" if at least one condition is true, *or* if both conditions are true. So in example (1), the statement is true if (a) my clothes are shrinking, or (b) I am gaining weight, or (c) if both are happening at once.

The following example illustrates the "and/or" version of choice modeled by the LOGO primitive, EITHER:

- i) ?PRINT EITHER (1 = 1) (2 = 4 + 5)
TRUE
- ii) ?PRINT EITHER (3 = 1) (4 = 4)
TRUE
- iii) ?PRINT EITHER (1 = 1) (5 = 5)
TRUE
- iv) ?PRINT EITHER (1 = 6) (7 = 9)
FALSE

In cases (i) and (ii) just one of the conditions is met; in case (iii) both are met—yet in all three cases, the LOGO command has returned TRUE. Only case (iv), where neither condition is true, has returned a FALSE.

This type of choice is quite different from what can be called the *exclusive or* alternative. This is often written, in legal documents and the like, to read "Either A or B, *but not both*." In example (2) above, the "either . . . or" of English can be interpreted in this light. For the claim "Either that creature is male or it is female" to be true, (a) the creature must be male, or (b) it must be female. But if (like some primitive life-forms) the creature is *both* male and female, then to most English speakers, it would seem that the original claim about the creature's gender is simply *false*.

From this we conclude that the built-in EITHER command of LOGO is not a suitable model for this second type of alternative. As shown above, the LOGO

Continued on p. 71

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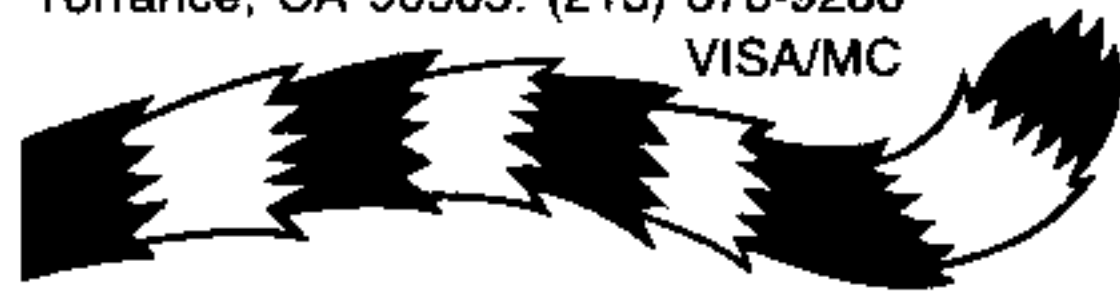


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LOGO Logician . . . from p. 69

EITHER will return a TRUE if both conditions are true. Yet what is needed for this second case is a choice which will be counted FALSE when both the conditions are TRUE.

A New Model

Once we see that a second model for expressing alternatives—beyond the built-in EITHER mode of LOGO—is required, our next task is to construct that new model. The procedure shown below, called EXCLUSOR, is designed to do the trick. The second procedure, EXCLUSOR?, is simply a routine to accept the two input conditions for the test, call up the EXCLUSOR procedure (which returns TRUE or FALSE), and then PRINT the output.

The two conditions for the test are input as lists (each enclosed within square brackets). The EXCLUSOR procedure embeds each input condition within an IF-THEN sentence—to form the if-condition of that sentence. As we RUN these sentences then, a flag is set for each input as TRUE if that condition is true, or FALSE if the condition is false. The two flags can then be tested in such a way that if they show both inputs to have been true or both to have been false, then the output FALSE can be generated; otherwise TRUE is output.

In the following example, the same inputs are provided as in the preceding example for the "and/or" alternative. Notice how the change in the model affects the output for case (iii):

- i) ?EXCLUSOR? [1 = 1] [2 = 4 + 5]
TRUE
- ii) ?EXCLUSOR? [3 = 1] [4 = 4]
TRUE
- iii) ?EXCLUSOR? [1 = 1] [5 = 5]
FALSE
- iv) ?EXCLUSOR? [1 = 6] [7 = 9]
FALSE

In any natural language it is easy to make an ambiguous assertion without realizing the many ways in which it can

be understood. But much that is vague can be clarified in the attempt to construct a *concrete model*. Then, like the child drawing pictures with Turtle Graphics, you get to see your mistakes externally. In this way, your modeling and debugging processes enhance your learning.

We have used LOGO to construct two models for alternatives. Had we begun by thinking that the English "either . . . or" was unambiguous, we would have learned through modeling that, in fact, there are two distinct interpretations. In some cases, the built-in version used by LOGO is sufficient to model the sense of an "either . . . or" expression; in other cases, a second model is required. This led us to construct that model.

In future columns, we'll pursue a similar method. By attempting to construct a LOGO model in some area of our experience or knowledge, we hope to eliminate confusion and understand the concepts involved more fully and completely.

LOGO PROCEDURES

```
TO EXCLUSOR A B
; EXCLUSIVE - OR FUNCTION
; REQUIRES L I S T S AS INPUT
MAKE "A SE "IF :A
MAKE "A SE :A [THEN MAKE "TA
"TRUE ELSE MAKE "TA "FALSE ]
RUN :A
MAKE "B SE "IF :B
MAKE "B SE :B [THEN MAKE "TB
"TRUE ELSE MAKE "TB "FALSE ]
RUN :B
IF NOT EITHER :TA :TB THEN
OUTPUT "FALSE
IF BOTH :TA :TB THEN OUTPUT
"FALSE ELSE OUTPUT "TRUE
END
```

```
TO EXCLUSOR? A B
PRINT EXCLUSOR :A :B
END
```

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Graphics ... from p. 14

rocket will disappear from the screen. Lines 500 to 560 change the colors of the explosion characters already on the screen in order to make them visible and add a few sound effects.

```

100 REM *****
110 REM * BASIC FIRE WORKS *
120 REM *****
130 REM BY W. K. BALTHROP
140 REM 99'er VERSION 2.9.1
150 REM
160 CALL CHAR(96,"0B0B0B1C1C1C3E3E")
170 CALL CHAR(104,"1C1C1C0B0B")
180 CALL CHAR(112,"10")
190 CALL CHAR(80,"10")
200 CALL CHAR(88,"10")
210 CALL CHAR(136,"FFFFFFFFFFFFFF")
220 CALL CLEAR
230 CALL SCREEN(2)
240 PRINT TAB(12);"X XXX"
250 PRINT TAB(11);"XXXPPXXX"
260 PRINT TAB(10);"XXXPPPPXXX"
270 PRINT TAB(7);"XXXPPPPPPPPXXX"
280 PRINT TAB(5);"XXXPPPPPPPPPPXXX"
290 PRINT TAB(7);"XXXPPPPPPPPXXX"
300 PRINT TAB(10);"XXXPPPPX"
310 PRINT TAB(11);"XXPPXX"
320 PRINT TAB(12);"XXX X": : : :
: : :
330 CALL COLOR(9,6,1)
340 CALL COLOR(10,7,1)
350 CALL COLOR(7,1,1)
360 CALL COLOR(8,1,1)
370 CALL COLOR(14,13,1)
380 CALL HCHAR(24,1,136,32)
390 CALL HCHAR(23,16,96)
400 FOR TD=1 TO 100
410 NEXT TD
420 FOR ALT=22 TO 9 STEP -1
430 CALL SOUND(-1000,880-(ALT/.05),30-ALT,1200,30-ALT,1600,25,-8,37-ALT)
440 CALL HCHAR(ALT,16,96)
450 CALL HCHAR(ALT+1,16,104)
460 IF ALT>21 THEN 480
470 CALL HCHAR(ALT+2,16,32)
480 NEXT ALT
490 CALL VCHAR(ALT,16,32,3)
500 CALL SOUND(500,110,10,-8,0)
510 CALL COLOR(7,16,1)
520 CALL SOUND(1000,110,2,-7,0)
530 CALL SOUND(1500,220,0,-6,0)
540 CALL COLOR(8,16,1)
550 CALL SOUND(4250,44000,30)
560 CALL SOUND(1,44000,30)

```

Animation

As time passed, new graphics tricks originating from an exponentially increasing user base really began to bring the computer to life. The next program example will demonstrate one of these animation routines. It is fairly simple just to move a character representing a person across the screen, but wouldn't it be nice to see him actually running across the screen with legs and arms pumping? It's not as difficult to accomplish as you might think. All you need to do is change the pattern of the character for each movement of the arms and legs, and replace one pattern with the next in sequence. The idea behind this process is not a new one: It has been used to make movies for nearly 80 years.

There are two ways to approach this effect. The first involves creating a series of graphics characters and placing them on the screen in succession. The second method, shown here, involves creating only one graphics character and changing the pattern definition of that character to animate it. This last method is by far the best, because you don't waste your number of characters, some of which can be used elsewhere. In addition, you can put several of the same characters on the screen and make them change without having to remember where each character is. Another advantage of this program is its use of DATA statements to store a screen display: When it's time to change the screen display, the program uses a FOR-NEXT loop to read the appropriate DATA statement.

In lines 160 and 170 the screen is cleared, and character number 48 (0) is defined as a solid block. In lines 180 to 200, variables A\$, B\$, and C\$ are assigned the pattern information for the running figure. Lines 210 to 240 contain the FOR-NEXT loop that reads the DATA statements in lines 380 to 450 and prints a pattern of character 0—now defined as a completely black block—on the screen. The patterns on the bottom of the screen are



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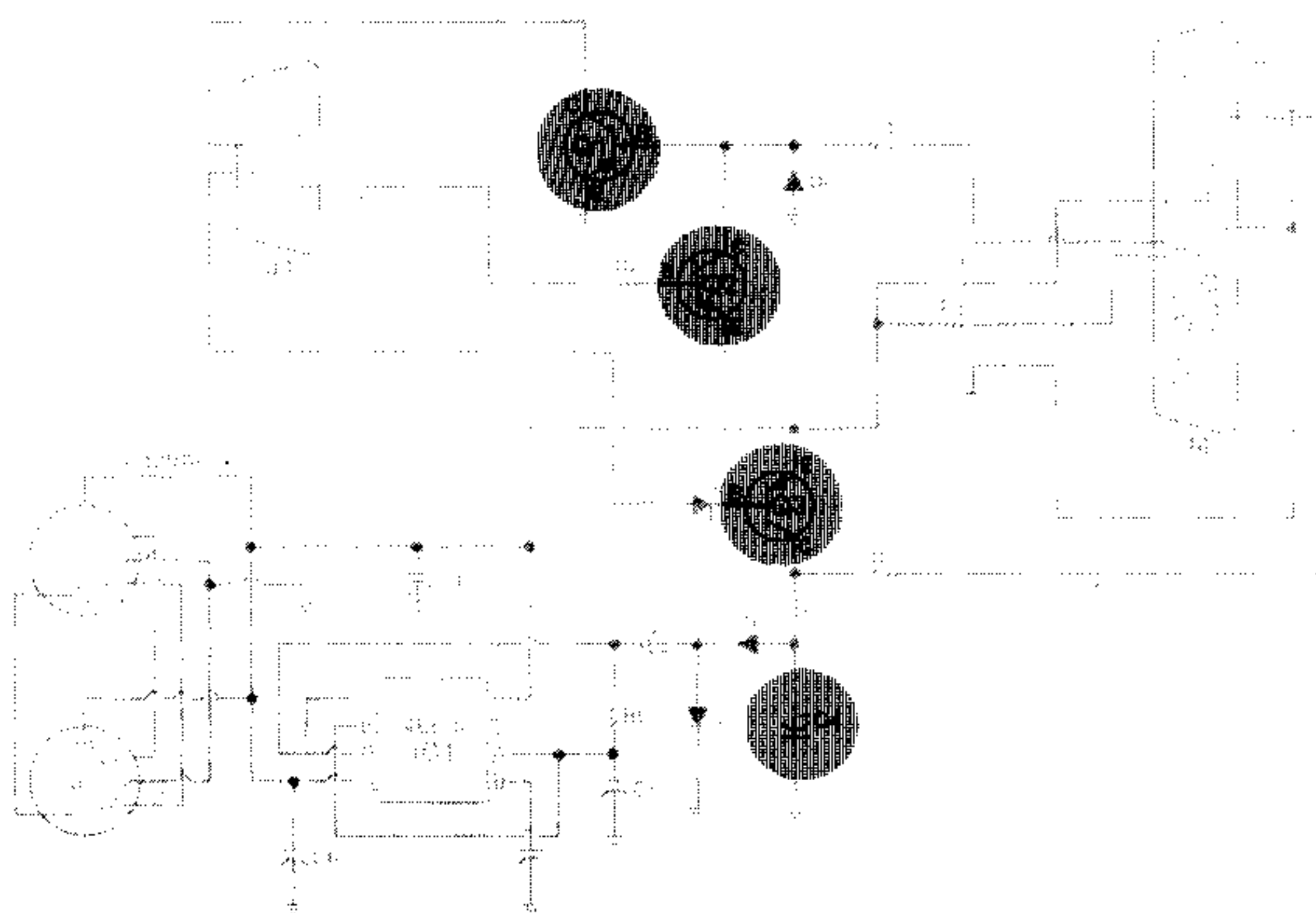


99'er Program Bug

In *Joytalk is Cheap* (June 1983), we inadvertently switched some of the components in the schematic diagram (Figure 4 on page 65). Q1 and Q2 are shown as PNP transistors; they are actually NPN transistors. Q3 is shown as an NPN transistor; it is actually a PNP transistor. (They are correctly identified in the Parts List on page 65.) Capacitor C4 is shown with negative to ground; it should be shown with *positive* to

ground. The accompanying figure displays the components correctly.

Lost Ruins strategists who have tried to avoid cave-ins by getting the robot out of the excavation site and *then* setting off all their extra explosives may have discovered that such cleverness results in a **BAD VALUE IN 1600** which breaks the program. To avoid this you must either have the robot set off all his charges *before* leaving the excavation site, thus risking a cave-in, or add this line: 1585 IF R1 > 2 THEN 860. The choice is yours.



Sorting . . . from p. 19

the sorting sequence with a stopwatch. The results were averaged and placed in Table 1.

The data in Table 1 represent the sort speeds with TI BASIC and 16K standard internal RAM. Though I do not include the actual figures here, I noted that the sorts ran approximately 20% slower with the 32K memory expansion attached.

As I expected, the more complex algorithms were, for the most part, significantly faster. It was interesting to note that the simpler routines were nearly as efficient as the others for very small lists of items. But the greater the length of the lists, the more efficient the complex routines became. Sorting 100 items resulted in an 8 to 1 ratio in time difference between the fastest (quick sort) and the slowest (bubble sort). [Although these programs sort numbers, the same program logic can also be used to sort alphabetically. All you need to do is to change the appropriate variables to string variables.—Ed.]

Program Listings

The listings begin by randomly selecting N items, according to the value placed in N, and printing them on the screen (lines 100-200). From there, each of the various sort routines (lines 210 to 600) sequences the numbers in ascending order. The listings end by printing the properly sorted numbers on the screen (lines 600-640).

Table 1

List Size	Bubble Sort	Selection Sort	Heap Sort	Shell Sort	Quick Sort
10	1.9	1.4	1.8	1.2	1.7
25	10.4	6.5	5.2	4	4.4
50	45.9	24.3	12.5	10.2	9.7
100	186	89.9	28.9	24.4	23
500	Forget it!	Forget it!	194	169.7	142.7
Average time in seconds					

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Graphics ... from p. 75

```
190 B$="1818085C3A181414"
200 C$="1818081838180818"
210 FOR X=1 TO 8
220 READ LINE$
230 PRINT LINE$
240 NEXT X
250 CALL SPRITE (#1,49,13,70,256,0,-9)
260 CALL SPRITE (#2,49,5,60,256,0,-8)
270 CALL SPRITE (#3,49,2,80,256,0,-10)
280 CALL SPRITE (#4,49,7,50,256,0,-7)
290 CALL CHAR (49,A$)
300 CALL CHAR (49,B$)
310 CALL CHAR (49,C$)
320 CALL CHAR (49,B$)
330 GOTO 290
340 DATA " 00 00 00 00"
350 DATA " 00 00 00 00"
360 DATA "0 0 0 0"
370 DATA " 000000 0 000 0"
380 DATA " 00 0 000 0 00"
390 DATA " 00 0 00 0"
400 DATA " 0 0 0 0"
410 DATA " 0 0 0 0 0"
```

Paddle Boat

In their search for increasingly realistic graphics displays, 99/4A users began to uncover hidden powers in Extended BASIC. This next program example demonstrates the ability of Extended BASIC to use animation to add realism to any program.

Paddle Boat demonstrates a few more capabilities of Extended BASIC. It also shows you how you can use CALL PATTERN instead of changing the pattern of one character with CALL CHAR. This program will display a boat, rider, and animated paddle moving across the lake.

Lines 160 and 170 clear the screen and set the screen color to light green. Lines 180 to 230 define the graphics character patterns, set the character colors, and

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display the lake. Line 240 sets the sprite magnification to 2, which doubles size. Lines 250 to 270 display the boat, man, paddle, and the splash from the paddle hitting the water, placing them all in motion together. Lines 280 to 300 change the patterns and determine when to change the color of the splash to make it visible.

```
100 REM *****
110 REM * PADDLE BOAT *
120 REM *****
130 REM BY W. K. BALTHROP
140 REM 99'ER VERSION 2.9.1XB
150 REM
160 CALL CLEAR
170 CALL SCREEN(4)
180 CALL CHAR(96,"1010101010101010
20201010080804040202010080404
028040201008040201")
190 CALL CHAR(100,"008060300C06010
00000E0300E030000000000FF00000
0000000030E30E00000")
200 CALL CHAR(104,"0001060B1060B00
00102040B102040B00204040B10202
04004040B0B10102020")
210 CALL CHAR(120,"FF7F3F1F00000000
0FFFFFFF00000000FF0E0C0B00000
000")
220 CALL CHAR(130,"181808187818FBF
B11285B")
230 CALL CHAR(48,"00"):: CALL COLD
R(3,5,5):: CALL HCHAR(10,1,48,
448)
240 CALL MAGNIFY(2)
250 CALL SPRITE (#1,96,15,93,256,0,-3)
260 CALL SPRITE (#4,120,13,99,236,0,-3,#3,121,13,99,244,0,-3,#2,122,13,99,251,0,-3)
270 CALL SPRITE (#5,130,7,85,244,0,-3,#6,131,1,109,256,0,-3)
280 FOR X=1 TO 12 :: CALL PATTERN(
#1,95+X):: IF X=12 OR X<3 THEN
CALL COLOR(#6,16)ELSE CALL CO
LOR(#6,1)
290 NEXT X
300 GOTO 280
```

Translated Fireworks

So many programming improvements have been made, and so many obstacles overcome, that it is interesting to reflect on those earlier programs. I have gone back over a few of my first programs and shaken my head in disbelief. If I had only known then what I know now. As a demonstration of how far we have come in these last

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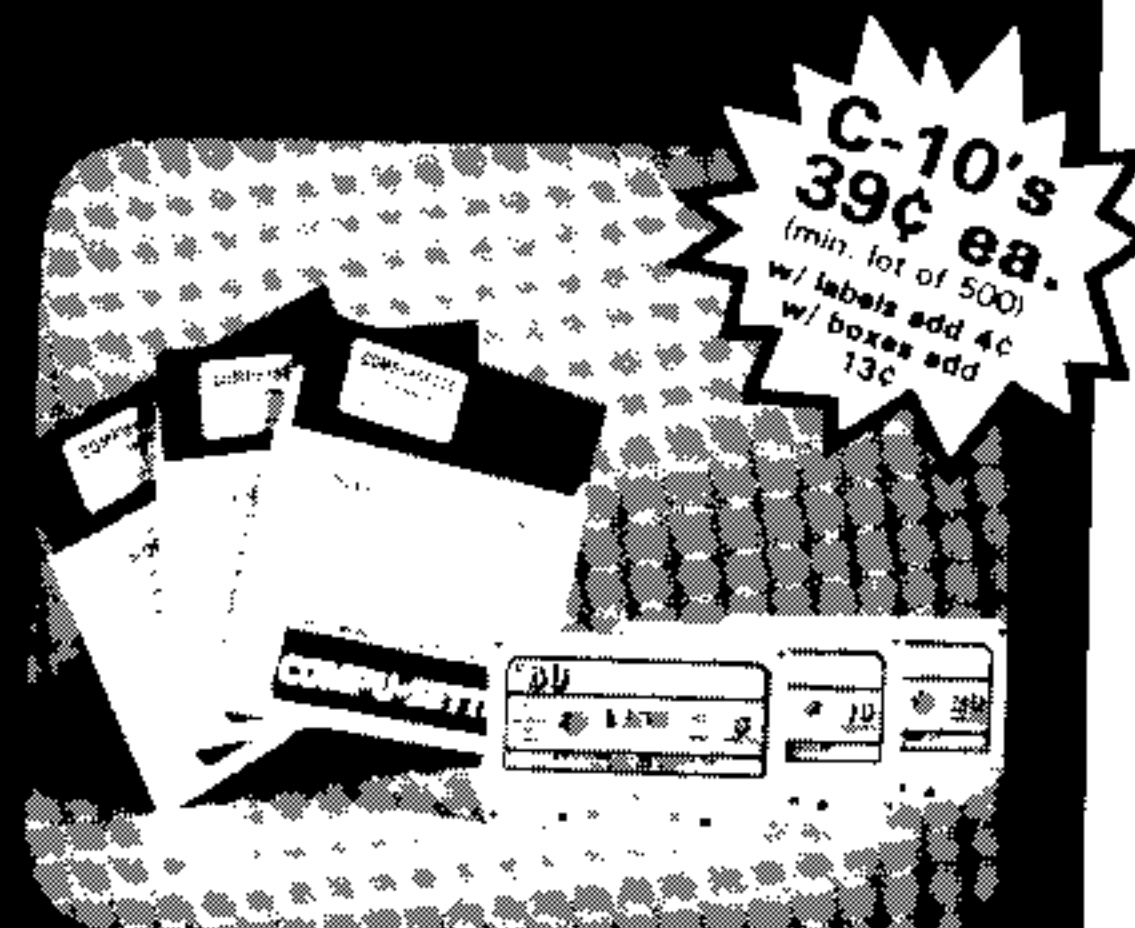
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few years, I tried modifying the *BASIC Fireworks* program to bring it up to speed. Translating the program into Extended BASIC was easy, and the results were fun. You might want to dig some of those oldies out of the closet and see how your expectations have risen.

My objective in rewriting this program was to get rid of the jerky movement of objects from one character position to another by using sprites. Lines 160 to 190 define the graphics characters. Line 200 clears the screen and sets the screen color to black. Line 210 defines the character colors. Line 220 displays the ground. Line 230 displays a sprite as a rocket preparing for blastoff. And while we're waiting for ignition, line 240 will place 26 invisible sprites above the rocket. Line 250 displays the rocket's thrust and sets the graphics for both rocket and thrust in motion. Lines 260 to 290 count down while the rocket soars, check its position, and give you some sound effects. When the rocket reaches the predetermined point, the program will go to line 300, which will give the sound of an explosion and set the color of the sprites to white. Line 310 removes the rocket and its flame from the screen.

Lines 320 and 330 will set the 26 sprites off in all directions, giving you the best fireworks display you'll see out of season. Line 340 returns to line 230 to start the whole process over again.

```

240 FOR X=3 TO 28 :: CALL SPRITE(#
X,112,1,72,128,0,0):: NEXT X
250 CALL SPRITE(#2,104,7,184,128):
: CALL MOTION(#2,-4,0,#1,-4,0)
260 FOR X=6000 TO 100 STEP -100 ::
CALL DDINC(#1,72,128,2,FIRE)
270 IF FIRE=-1 THEN 300
280 CALL SOUND(-1000,220,INT(30-(X
/200)),330,INT(30-(X/200)),440
,INT(30-(X/200)),-7,INT(30-(X/
200)))
290 NEXT X
300 CALL SOUND(-4250,110,2,220,2,3
30,2,-7,0):: FOR X=3 TO 28 ::
CALL COLOR(#X,16):: NEXT X
310 CALL DELSPRITE(#1,#2)
320 FOR X=3 TO 28 :: CALL MOTION(#
X,RND*10-5,RND*10-5):: NEXT X
330 FOR X=3 TO 28 :: CALL COLOR(#X
,1):: NEXT X
340 GOTO 230

```

Bright Future

What we are seeing in computer graphics today will seem crude in a few years. We are already working with three-dimensional graphics (*Sprites in Depth*, May, 1983). We're starting to find enhancements in the system and languages which were never before explicit. (See *Pulling the Shade on Sprites*, March, 1983.) Because of the bit-map graphics capability of the TMS9918A video display processor in the 99/4A console, a whole new generation of programs is emerging. *Parsec* was the first software product from Texas Instruments which used bit-map graphics. Several other programs which seem every bit as promising were just announced at the Summer CES show. (See the article on CES in this issue.) *Microsurgeon* (featured on this month's cover) is a case in point. Not only does it offer very fine graphic detail (witness the bedside chart), but it also illustrates an effective "windowing" technique.

So if the old graphics displays have become boring, if they just aren't living up to your rising expectations, fear not: There is a revolution going on. It's the software revolution, and we have only just begun to see the results in higher-quality graphics for the TI-99/4A.



```

100 REM *****
110 REM * X BASIC FIRE WORKS *
120 REM *****
130 REM BY W. K. BALTHROP
140 REM 99'ER VERSION 2.9.1XB
150 REM
160 CALL CHAR(96,"080B1C1C1C1C3E3E
")
170 CALL CHAR(104,"1C1C1C080B0B")
180 CALL CHAR(112,"10")
190 CALL CHAR(136,"FFFFFFFFFFFFFF
F")
200 CALL CLEAR :: CALL SCREEN(2)
210 CALL COLOR(9,6,1):: CALL COLOR
(10,7,1):: CALL COLOR(11,16,1)
:: CALL COLOR(14,16,1)
220 CALL HCHAR(24,1,136,32)
230 CALL SPRITE(#1,96,6,176,128)

```


[illegible]

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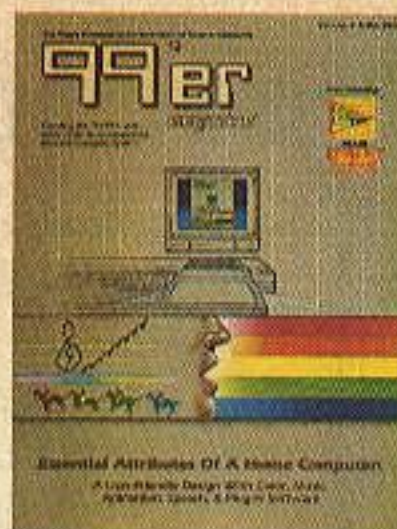
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Pulsar . . . from p. 24

perish in a rather spectacular depiction of
a star going super-nova.

At the top of the screen is a readout
displaying the name of each new solar
system. The bottom of the screen shows
you the vital statistics: number of ships left,
amount of ore taken in, and total points
accumulated.

Sight and Sound

Pulsar's graphics show some careful
thought and imagination. They are not so
complex that they distract you, nor are
they so simple that they become boring.
In fact, I feel that the graphics may be
Pulsar's best feature. At different moments
during the game, you will also find yourself
listening to the sound effects and wonder-
ing how they were done. The fades and
tonal manipulations utilize the sound
generator of the TI-99/4A effectively. Those
of you who have the Speech Synthesizer
will find on side two of the *Pulsar* tape a
special version featuring speech. Since the
game is written in Extended BASIC, the
speech is nothing spectacular, but it is used
tastefully.

Command Response

There is no friction in space, and there's
no friction in *Pulsar* either. It takes a bit

Mean Streets . . . from p. 24

diagonally, or from behind buildings, so
the cops and criminals must face each
other in *High Noon*-style duels. An option
to let you ricochet bullets off buildings
(which we have seen in other games) or
fire from an angle would make the game
both more enjoyable and more realistic.

Response

The game's response to your (joystick or
keyboard) control makes this an extremely
challenging and at times, frustrating, game.
Your cop tends to move as if he is sprint-
ing in argyle socks on a freshly waxed
floor. You must learn to compensate for
this "slide factor" if you want him to stop
on the dime (an important consideration
in aiming at the enemy). When you hit the

of adjusting to get accustomed to this, and
it will undoubtedly prove frustrating at first.
But with experience you may find that this
feature adds to the realism and difficulty
of the game. The response of the game
also seems a little unreliable when you are
signaling to the mother ship. If your tim-
ing is off, the mother ship passes right over
you. Your only hope, a slim one at that,
is that you still have enough time to catch
her the next time around.

Documentation

The 12-page booklet that comes with
Pulsar is well-written, and its four-color
cover sports a captivating piece of artwork.
It doesn't tell you, however, to disconnect
your disk drive system if you don't have
the 32K memory expansion—otherwise,
you get a MEMORY FULL message.

For me the most disappointing aspect of
Pulsar is that it is written in Extended
BASIC, and not in Machine Code. But
even so, it does provide more than games
of this type normally do. *Pulsar* makes
such good use of the TI-99/4A that you will
probably find yourself using it to
demonstrate your computer to your
friends. But demonstrator beware—you
may end up having to wait in line to get
to play your own *Pulsar* again. 

SLAG members, there is a short delay
before they die, and they sometimes fire
at you during that time. It can be frustrating
to hit your target and then see your cop
crumple. The directions do warn you that
a wounded SLAG'er can fire back, but
there is no way to tell whether they are
wounded or dead.

Imprecise movement and slow guns
may try your patience, but for me, the
most frustrating threat in *Mean Streets* is
the grenade. The directions say that you
will be warned before the fiends drop a
grenade from one of the buildings. When
the warning flashes, however, the cops
seem to freeze in fear. No matter how
feverishly I pushed the joystick or jammed
the keys, the men in blue would not
budge.

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Realistic Violence?

Those who are concerned about violence in computer games may immediately recoil at the theme of *Mean Streets*. But while the game's graphics are strong on realism, its scenario is well within the realm of fantasy. I personally tended to view it much the way I would a thirties gangster movie—as a stylized exaggeration that has little to do with reality. From the game's gangbusters beginning (a squealing siren set against an animated collage of handcuffs, police badges, handguns, and money bags) it is difficult to take it very seriously. Just as you tend to forget about police brutality when the movie cops are about to nail Scarface or Dillinger, it is probably best, with *Mean Streets*, to suspend your moral judgments and regard this as a Hollywood-style parable of good vs. evil. That way you won't be outraged that the ambulance pulls up when a cop is shot, while the terrorist is left to die on the street like a dog. Keep in mind that the

odds are against the men in blue. As in any big city, there is a small number of cops (10) and an infinite number of criminals. And this gang makes the Red Brigade look like a bunch of cub scouts. So even though your cops get preferred treatment, there is no way you can really win. As in real life, the most you can hope for is a high score before you punch out.

Mean Streets offers a colorful and original theme (big city crime) and superior graphics. The instructions for loading and playing the game are clear and comprehensive. (They don't tell you, however, to disconnect your disk drive system if you don't have the 32K memory expansion—otherwise you get a MEMORY FULL message. This means that you *must* have the 32K memory expansion if you buy the version on disk.) The game itself is just another shooting gallery scenario, with a few twists. But it is a challenge, and with a few changes (better mobility for the cops and ricocheting bullets) it could be a real

strategy game with ambushes and fancy shooting. As it is, however, the best you can hope for is to prolong the lives of your doomed SWAT team as long as you can before the tanks roll in with the devastating message, YOU HAVE FAILED. NATIONAL GUARD CALLED IN.

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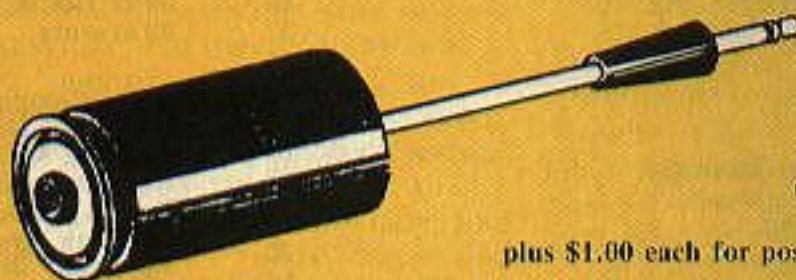


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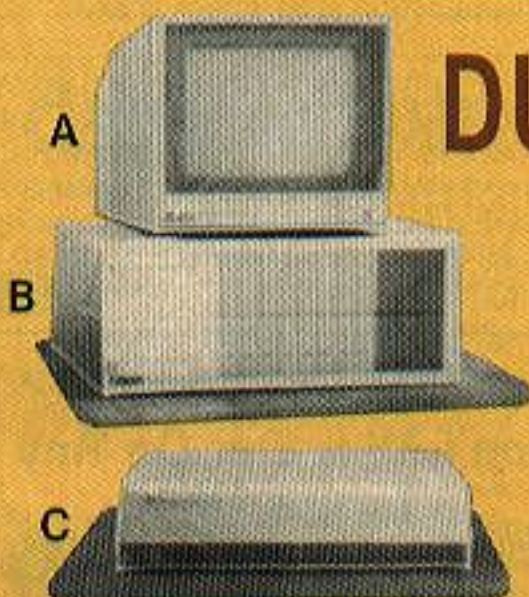


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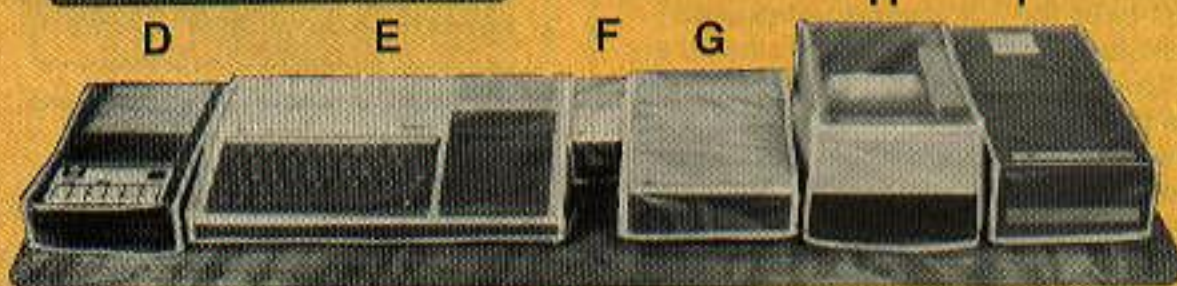
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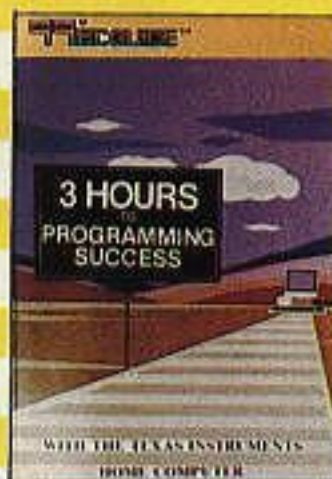


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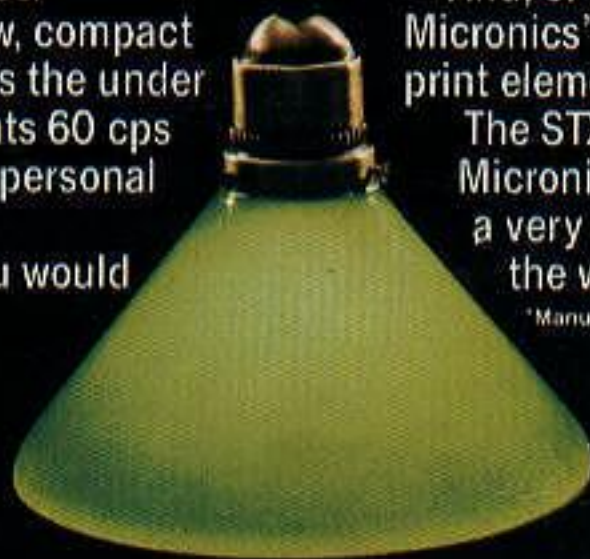
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